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Technical Memorandum

North Works Sediment Probing Study August 2007

September 25, 2007

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North Works Sediment Probing Study August 2007

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Technical Memorandum

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Appendices

1. Introduction

ARCADIS BBL has prepared this memorandum to present results of the sediment probing investigation at the BASF Corporation (BASF) North Works facility (the Site) located in Wyandotte, Michigan. The sediment probing study was conducted according to a plan approved by the United States Environmental Protection Agency (USEPA). Field activities took place from August 27 to August 31, 2007 in support of the Corrective Measures Study (CMS) for the Site. Representatives from USEPA were present to observe investigation activities on August 29; MDEQ provided additional oversight on August 28 and 29.

1.1 Data Quality Objectives

As stated in the Sediment Probing Study Data Quality Objectives and Work Scope memorandum (ARCADIS BBL 2007, Appendix A), the primary objective of this study was to "evaluate the presence or absence of soft, fine-grained sediments…in order to determine whether any further investigation of the sediments is warranted." This determination is to be made based on the amount of, and locations of, fine-grained sediments encountered in the Trenton Channel; a soft sediment threshold thickness of one foot or greater was adopted for these purposes. Additional data collected in support of this objective include water depth and total depth-to-bottom of probe-able sediments. Sediment core samples were taken at select locations to visually evaluate sediment column characteristics.

1.2 Scope of Work

Sediment probing was performed from a work boat along transects perpendicular to the North Works shoreline. Transects were spaced at approximately 200-foot intervals from the upstream property line to the downstream property line. Figure 1 shows the actual probing transects. Transects 16 and 17 were planned but not sampled due to the presence of a submerged historic pipeline that was not precisely located at the time of the investigation. Avoiding probing along these two transects prevented potential accidental rupture of the pipeline.

At each location, water depth, total probing depth, and positional coordinates were recorded. Survey coordinates were established using RTK GPS tied to local survey benchmarks in Michigan State Plane Coordinate System. Grab samples were collected at 22 of the probing locations using a Ponar dredge sampler. Ponar samples were photographed and visually classified to provide a record of representative sediment types encountered along the Site. Vibracores were also taken in six locations to provide information on sediment stratigraphy at the Site.

2. Probing Study Results

2.1 Survey Control

Two baseline survey control points were established on the Site by the ARCADIS BBL field crew for the purposes of the probing study (see Table 1 for coordinates). Elevations at the survey control points are based on the National Geodetic Vertical Datum of 1929 (NGVD29), and coordinates at control points are based on NAD83 international feet MI south.

2.2 Probe Depths

Sediment probing was performed at locations 10, 20, 30, 40 and 50 feet from shore along transects (Figure 1) using a 3/4 inch diameter steel rod with one foot markings. Probing was also performed at 75 and 100 feet from shore if significant amounts of fine-grained sediments (defined as more than 1 foot of probe-able sediments) were present in the first 50 feet of each transect. Water depth and depth of probe-able sediment were recorded.

Table 2 shows the depth of probing at each location, and Table 3 reports water depths measured at each location. Sample coordinates are provided in Appendix B. Significant probing depths (>1 foot) were not encountered in the first 50 feet of Transects 2 through 15 (Figures 2 through 4); probing depths were generally less than 1 foot in this area. As a result, probing was not performed at 75 and 100 feet from shore along Transects 2 through 15. Measured water depths in this area exceeded 15 feet at every location. Along Transect 18 and further downstream, probe-able depths increased, and probing was completed at all locations along transects (Figures 5 and 6).

Results show that the northern area of the site from Transect 15 and upstream is a non-depositional area with minimal thickness of probe-able sediment. Figure 7 shows the limits of probing encountered at the northern end of the Site. Transect 1 had a probe depth of 6.9 feet at a location 50 feet from shore. Maximum probe depths at Transects 2, 3, and 4 were 3.6, 2.9, and 1.2 feet, respectively. Transects 6, 11, and 15 (Figures 8, 9, and 10, respectively) are representative of the remainder of the northern portion of the Site and exhibit low probing depths, predominantly less than 1 foot. As discussed in Section 2.3, sediment types in this area are predominantly coarse-grained materials, with exception of nearshore sediments of the very upstream end of the Site.

Transect 18 is located off the easternmost point of the North Works property, approximately where the shoreline adjacent to the Site begins to bend westward. South of this point, probe depths were generally greater than to the north. Figure 11, depicting the profile of Transect 18, shows a slight increase in probe depths relative to those measured in transects to the north. Moving further south, profile views of Transects 21 and 26 (Figures 12 and 13) display increases in probe-able sediment depth, with a maximum probing depth of 15.7 feet reached in Transect 26. Transect 29 (Figure 14) has lower probe depths, with a maximum of 5.8 feet at 30 feet from shore.

Figure 15 shows a histogram of probe depths encountered in Transects 18 through 29. Sixteen of 83 locations displayed probing depths less than two feet. Five of these locations were located at transect stations ten feet from the seawall (see Table 2) and had no probe-able sediments. The maximum probe-able depth encountered in the southern area of the Site was 15.7 feet, and the average was 5.9 feet.

2.3 Ponar Samples

Ponar grab samples were taken at 22 of the probing locations (see Figures 2 through 6) and were visually classified into four categories: Gravel, sand, sandy silt, and silt. Table 4 contains descriptions of each sample, along with the final classification of the sample into the above categories.

Samples taken in Transects 1 through 19 contain coarse materials (such as sand and gravel) typical of a scoured bottom where relatively little or no sedimentation of fine material apparently occurs. 54% of ponar samples taken in the northern portion of the Site were gravel and 46% of samples were sand.

Substantial fine-grained materials, such as sandy silt and silt, are not encountered until Transect 21. Of the ponar samples in the southern area of the Site, 33% of sample locations were classified as sand, 22% of sample locations were classified as sandy silt, and the remainder were classified as silt. Samples taken in Transect 29 contained sand and rocks, suggesting that conditions at the very southern end of the Site vary in depositional characteristics. At a number of attempted ponar locations, no material was recovered.

2.4 Vibracores

Six Vibracore samples were taken for visual inspection at locations T-1-50, T-19-40, T-20-10, T-20-100, T-29-75, and T-25-50 (Figure 16). Recovery depths are summarized in Table 5. Vibracores were collected from a work boat using 10-foot long aluminum cores, which were subsequently cut open by slicing along the length of the core on each side and then photographed. Sample locations are depicted on Figure 16 and summarized in Table 5. A

Photographic Log is included as Appendix C. Following is a description of each Vibracore sample.

2.4.1 Transect T-1-50

This Vibracore sample was collected approximately 50 feet from shore near the north property line of the Site. Approximately 7.5 feet of recovery was observed, with the upper 3.5 feet consisting of sediment and the lower 4.0 feet consisting of clay. The probe depth of this location was 6.9 feet. The visual description of the core is:

- 0 to 2.5 feet – dark gray silt, fine to medium sand, trace fine gravel, odor
- 2.5 to 3.5 feet – dark gray/black medium to coarse sand, some fine gravel, odor
- 3.5 to 7.5 feet – gray/brown clay

2.4.2 Transect T-19-40

This core was located approximately 40 feet from the shoreline in about 24.8 feet of water. Approximately 6.6 feet of recovery was observed and consisted of fine material intermixed with coarse-grained materials throughout. The probe depth at this location was 4.3 feet. The visual description of the core is:

- 0 to 0.4 feet – gray silt, medium sand, and fine to medium gravel
- 0.4 to 2.4 feet – dark gray coarse sand, fine to medium gravel
- 2.4 to 3.2 feet – dark gray silt, medium sand, trace fine gravel
- 3.2 to 6.6 feet – brown medium to coarse sand, fine to medium gravel with shells

2.4.3 Transect T-20-10

Vibracore sample T-20-10 was located approximately ten feet from the shoreline in about 18.2 feet of water. Approximately 4.7 feet of recovery was observed, compared to a probe depth of 10.6 feet. This core contained predominantly fine-grained materials throughout. The visual description of the core is:

- 0 to 4.6 feet – dark gray silt, some fine to medium sand, trace fine to medium gravel

- 4.6 to 4.7 feet – light gray silt, fine sand

2.4.4 Transect T-20-100

Vibracore sample T-20-100 was located approximately 100 feet from the shoreline in about 28.2 feet of water. Approximately 5.7 feet of recovery was observed. This core was described as predominantly sands and gravels, with some silts present in the 0 to 2.8 foot interval, and the probe depth at this location was 5.4 feet. The visual description of the core is as follows:

- 0 to 2.8 feet – light gray silty material, fine to medium sand, trace gravel
- 2.8 to 3.4 feet – light gray medium to coarse sand, trace fine to medium gravel
- 3.4 to 3.5 feet – gray coarse sand, medium to coarse gravel
- 3.5 to 4.5 feet – light gray medium to coarse sand, trace fine to medium gravel
- 4.5 to 5.7 feet – brown medium to coarse sand, medium to coarse gravel

2.4.5 Transect T-29-75

Vibracore sample T-29-75 was located approximately 75 feet from the shoreline in about 16.7 feet of water. Approximately 7.8 feet of recovery was observed versus a probe depth of 12 feet. Fine-grained materials were observed throughout. Below is a summary of the recovered material:

- 0 to 2.8 feet – gray silt, odor
- 2.8 to 7.8 feet – gray silt, fine to medium sand

2.4.6 Transect T-25-50

Although requested by the USEPA, a Vibracore sample could not be collected at the T-24-10 location due to obstruction by a U.S. Army Corps of Engineers barge docked at the site (see photo # 22). The USEPA and Michigan Department of Environmental Quality (MDEQ) were notified by a representative from BASF (Michael Gerdenich) and alternate locations were identified.

The T-25-20 and T-25-30 locations were selected as alternates to the T-24-10 location. After multiple attempts, no sediment was recovered at either location. Subsequently, a sample was obtained at the T-25-50 location. Approximately 5.5 feet of recovery was observed, versus a probe depth of 9.1 feet. The core contained silts and sands and some gravel. A visual description of the core follows:

- 0 to 2 feet – gray/brown silt, fine to medium sand
- 2.5 to 2.9 feet – gray/brown silt, fine to medium sand, and coarse gravel
- 2.9 to 4.5 feet – gray/brown silt, fine to medium sand
- 4.5 to 5 feet – gray silt, fine to medium sand

2.5 Summary of Results

Results indicate the northern area of the Site from Transect 15 and upstream is predominantly non-depositional, displaying minimal thicknesses of probe-able sediment (average 0.9 feet) and predominantly coarse-grained materials with the exception of Transects 1, 2 and 3, whose maximum probe depth varies between 20 and 50 feet from shore (6.9, 3.6, and 2.9 feet, respectively), reflecting the presence of a bench of probe-able material along a near shore drop-off that thins out moving downstream. Downstream of Transect 3 to Transect 15 probe depths are low (typically <1 foot) and generally decrease with increasing distance from shore. Material sampled with both ponar and Vibracore methods in this area indicate sediment types are predominantly coarse-grained, with a number of attempted samples yielding no material due to larger materials (e.g. rock, cobble).

Moving south of Transect 18, probe-able depths begin to increase relative to those measured in the northern portion of the Site. Five transects in this portion had zero probe-able material 10 feet from the seawall. Probe depths typically are greatest within 50 feet from shore and decrease further out into the channel. This increase in probe-able depth is accompanied by a corresponding shift in materials encountered toward coarser grain sizes. Transect 29 contains coarse sand and small rocks, suggesting the presence of varying depositional conditions along the extreme southern end of the Site.

References

ARCADIS BBL. 2007. Memorandum from Michael Erickson to Juan Thomas, USEPA. Subject: Sediment Probing Study Data Quality Objectives and Work Scope. Syracuse, NY, July, 2007.

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Table 1 - Survey Control

Benchmark ID	Northing	Easting	Elevation	Description	Remarks
BASF-03	262932.7	13453039.7	578.94'	NR	Coordinates are based on NAD83 fti MI south. Elevations are based on the National Geodetic Vertical Datum of 1929.
BASF-04	263216.4	13453007.7	580.60'	NR	

Notes: 1. NR = not reported.

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Table 2 - Sediment Depth at Probing Locations

	Distance from Seawall						
Transect ID	10	20	30	40	50	75	100
T1	0	0	0.5	0.8	6.9	**2**	1.5
T2	3	2.8	3.6	1	3	NA	NA
T3	0.3	**2.9**	1.8	1.4	0.8	NA	NA
T4	0.5	0.2	1	**1**	1	NA	NA
T5	0	1.1	**0.5**	0.8	0.5	NA	NA
T6	**1.4**	0.8	1	0.7	0.7	NA	NA
T7	**1.3**	0.4	0.8	0.5	0.8	NA	NA
T8	0.3	0.2	0.8	0.8	0.9	NA	NA
T9	0.2	0.2	0.4	0.4	0.3	NA	NA
T10	0	0.2	**1.7**	1.1	0.9	NA	NA
T11	0.1	0.9	0.5	**1**	0.1	NA	NA
T12	0.5	0.4	0.1	0.3	0	NA	NA
T13	0	0	**1.8**	0.2	0.3	NA	NA
T14	**2**	1	0	0	0	NA	NA
T15	0.1	0.2	0.5	1.2	**1.4**	NA	NA
T16	NA	NA	NA	NA	NA	NA	NA
T17	NA	NA	NA	NA	NA	NA	NA
T18	0.9	0.2	1.5	**3.9**	3.4	2.3	2.5
T19	11.2	5.2	**6.2**	4.3	3.2	2.7	4
T20	10.6	7.5	7.1	6.2	6.1	3.6	5.4
T21	**13.1**	6.5	11	9.3	7.6	**6.1**	6.1
T22	0	1.8	1.5	2.7	2.7	1.2	1
T23	0.1	0.1	3.8	1	3.8	4.3	5
T24	11.6	11.3	10.5	8.9	4.2	5.3	5.2
T25	NA	13.2	13.7	12.3	**9.1**	8.1	4.9
T26	0	1.4	**15.7**	10.5	9.5	10	**10**
T27	0	**12.1**	9.1	11	6.5	6.2	4.7
T28	0	8.9	**6.8**	6.7	3.2	8.7	7.7
T29	0	**4.5**	5.8	4.3	3	12	**3.3**

Notes:
1. NA = data not collected.
2. Sediment depth and distance reported in feet.
3. Values in bold indicate ponar locations.

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Table 3 - Water Depth at Probing Locations

	Distance from Seawall						
Transect ID	10	20	30	40	50	75	100
T1	4.1	4.1	11.3	13.2	15.9	22	24
T2	17	18.4	21.2	22	22	25	27.1
T3	19	20	22.1	22.9	23.9	NA	NA
T4	19.8	22.4	23.9	24	25.1	NA	NA
T5	20.9	22.9	24.9	25.2	26	NA	NA
T6	20.8	22.4	24.9	25.3	25.2	NA	NA
T7	19.5	21.5	24.2	25	25.5	NA	NA
T8	17.9	19	22	23	24	NA	NA
T9	18	20	22.8	23.2	23.5	NA	NA
T10	16.4	19.8	21.2	22.2	23	NA	NA
T11	19.9	21.1	22	22.2	22.6	NA	NA
T12	17.8	19.2	20	20.5	21.9	NA	NA
T13	16.7	18.8	22.4	23.8	24.3	NA	NA
T14	15.7	17.7	20	20.2	22	NA	NA
T15	15.7	18.2	20.5	23.4	23.8	NA	NA
T16	NA	NA	NA	NA	NA	NA	NA
T17	NA	NA	NA	NA	NA	NA	NA
T18	18	21.9	24.5	25	26.1	29	31.5
T19	16.1	20.8	23.1	25	26.8	29	31
T20	18.2	21	22.7	24	24.7	27.1	28.3
T21	14.9	18	20	22.2	23.5	26	27.9
T22	13.1	15.9	17.6	18.1	20.6	22.9	24.5
T23	19	19.9	21	23.9	24	24.7	25
T24	14.2	17.3	18	19.8	25	22.3	26.3
T25	NA	12.2	14.9	16	17	21.9	26.5
T26	3.8	10.2	11.5	16.9	18.2	20	21
T27	3.2	8.9	11.9	13.9	15.5	19	20.1
T28	5.9	11.1	13.2	15.8	17.2	19.6	21.2
T29	3.5	8.8	9.4	11.1	12.1	16	21

Notes:
1. NA = data not collected.
2. Sediment depth and distance reported in feet.

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Table 4 - Ponar Sample Descriptions and Classification

Location	Description	Classification
T1-75	Dark brown fine medium sand, some silt, fine to medium gravel (trace).	Sand
T3-20	2 attempts - only gravel and rock recovered.	Gravel
T4-40	Dark brown/medium coarse sand, trace silt, medium to coarse gravel, sheen. Mild organic odor.	Sand
T5-30	Dark brown fine-medium sand, medium-coarse gravel, cobbles, brick/trace clay/trace silt.	Gravel
T6-10	3 attempts. Medium coarse gravel/trace brown sand, rock.	Gravel
T7-10	Medium coarse gravel/trace coarse sand/trace gray clay/some brick.	Gravel
T10-30	1 large rock, trace sand. 1.7' off probe depth, potentially between rocks. 3 attempts.	Gravel
T11-40	Brown medium-coarse/sand. Medium-coarse gravel, trace silt.	Sand
T13-30	Some medium to coarse sand (brown), gravel medium to coarse/rocks.	Gravel
T14-10	Rock/gravel, trace sand.	Gravel
T15-50	3 attempts - no recovery. Trace sand in ponar.	Sand
T18-40	Gray brown medium sand/trace silt/trace fine gravel, and trace sheen/organic odor.	Sand
T19-30	Dark gray medium to coarse sand, trace gravel. Trace sheen and organic odor.	Sand
T21-10	Dark gray silt/fine and medium sands, trace fine gravel/sheen and organic odor.	Sandy silt
T21-75	Fine and medium sand, some silt. Fine and medium gravel, trace organics, sheen, organic odor.	Sand
T25-50	Light gray/brown silt w/trace fine sand, slight sheen, organic odor observed.	Silt
T26-30	Dark gray, sandy silt. Trace fine gravel, trace organic odor.	Silt
T26-100	Dark gray/brown loose silt, medium to coarse sand and gravel, some organic odor.	Sandy silt
T27-20	Seaweed with some dark gray/brown silt, medium gravel. Trace brown fine/medium grain sand.	Silt
T28-30	Clayey silt, dark gray, some fine sand, trace medium gravel, trace organic material.	Silt
T29-20	Large rock (rip rap), gravel, some soft silt. Dark gray/brown medium to coarse sands; no odor/sheen.	Sand
T29-100	Little recovery - medium grain brown sand, trace silt, rocks 1-3".	Sand

Notes: 1. Descriptions taken from field logs.

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Table 5 - Vibracore Locations

Transect	Distance from Seawall	Recovery Depth
T1	50	7.5
T19	40	6.6
T20	10	4.7
T20	100	5.7
T25	20	0
T25	30	0
T25	50	5.5
T29	30	0
T29	75	7.8

Notes:

1. Recovery depths and distance reported in feet.
2. Two attempts made at both T25-20 and T25-30; no recovery.
3. Three attempts made at T29; no recovery.

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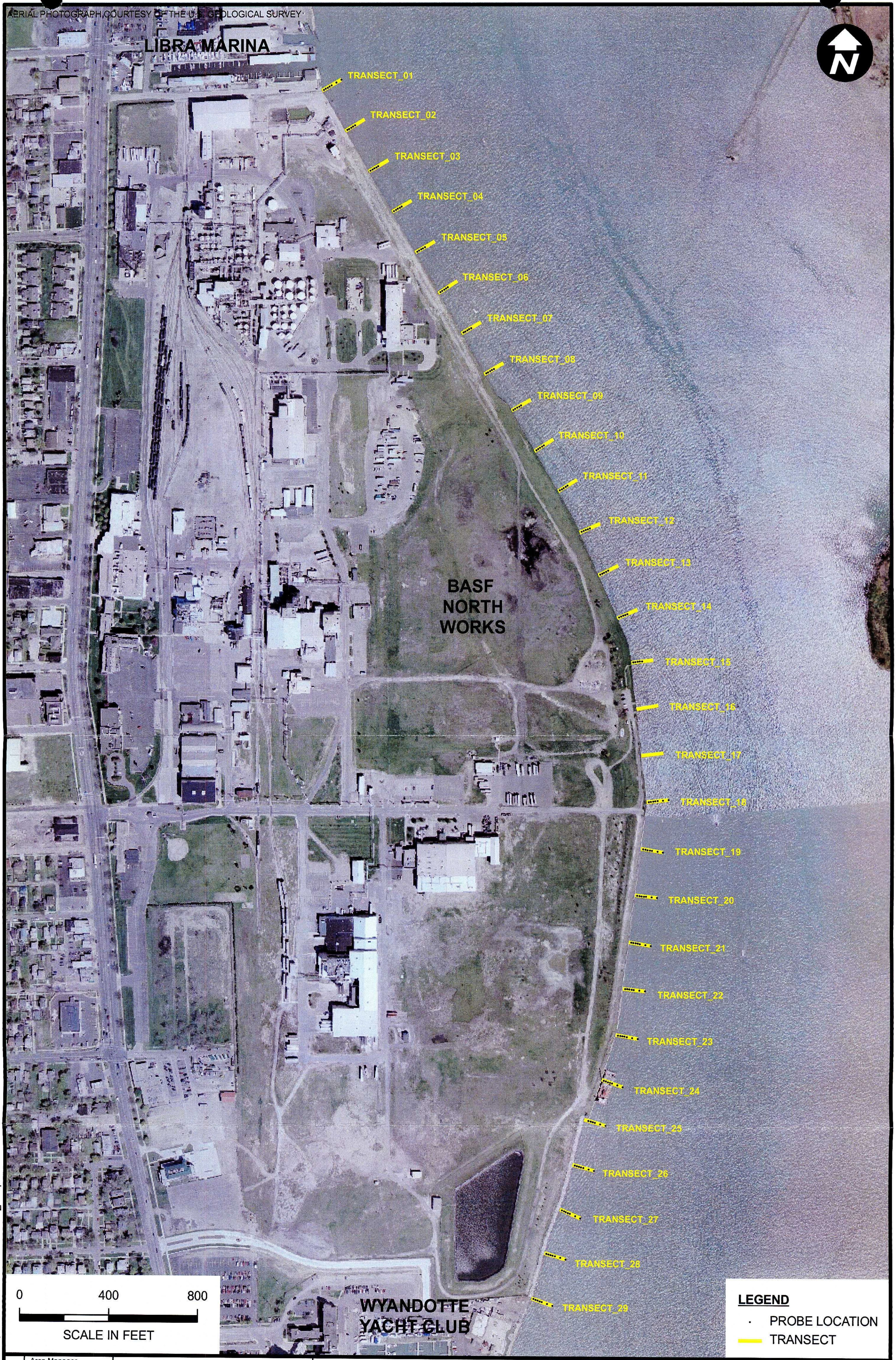
Figures



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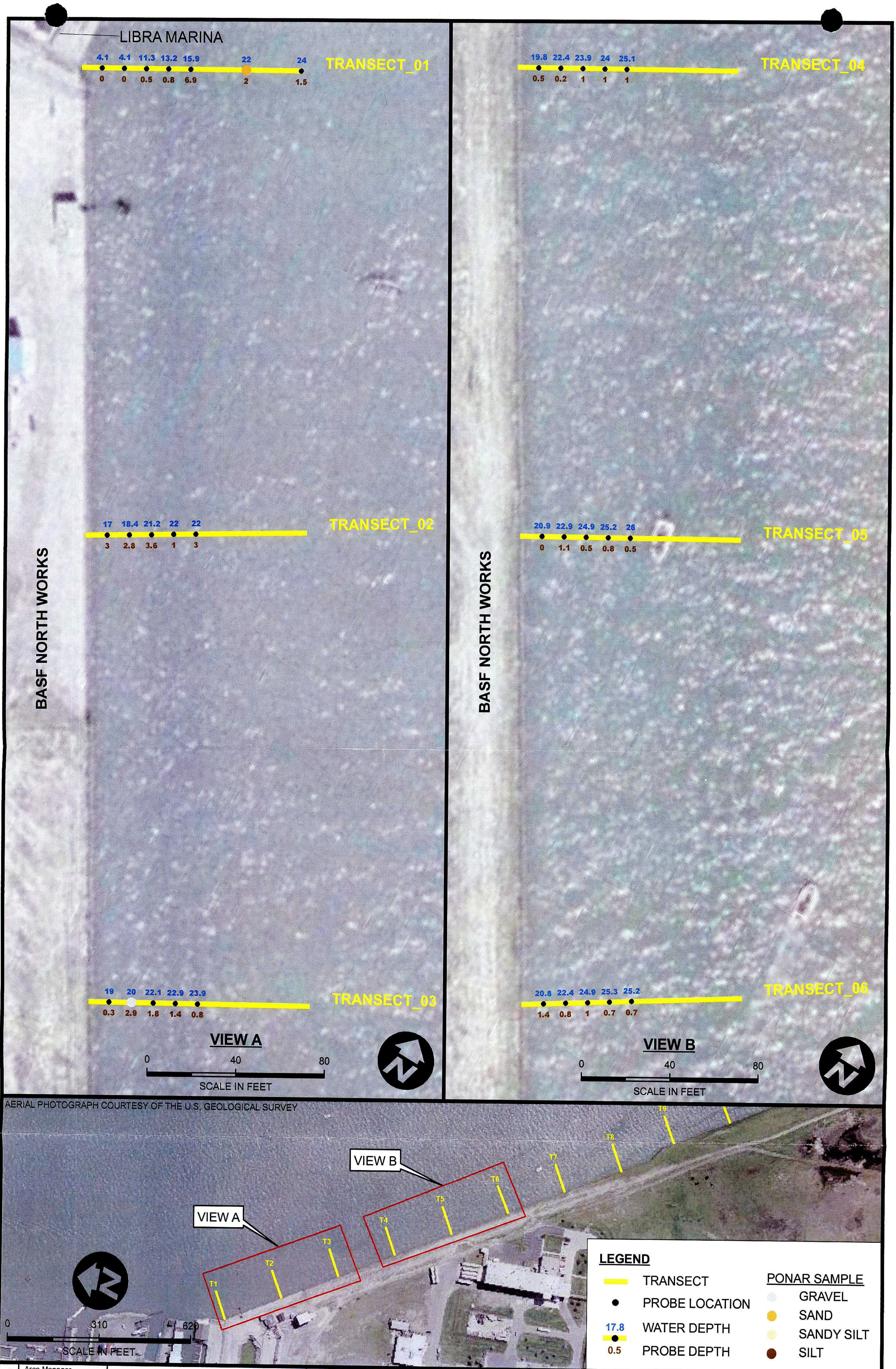

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PROBING LOCATIONS
TRANSECTS 01-03 AND 04-06
NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
TECHNICAL MEMORANDUM

WYANDOTTE, MICHIGAN

Project Number	BO042929.00.10
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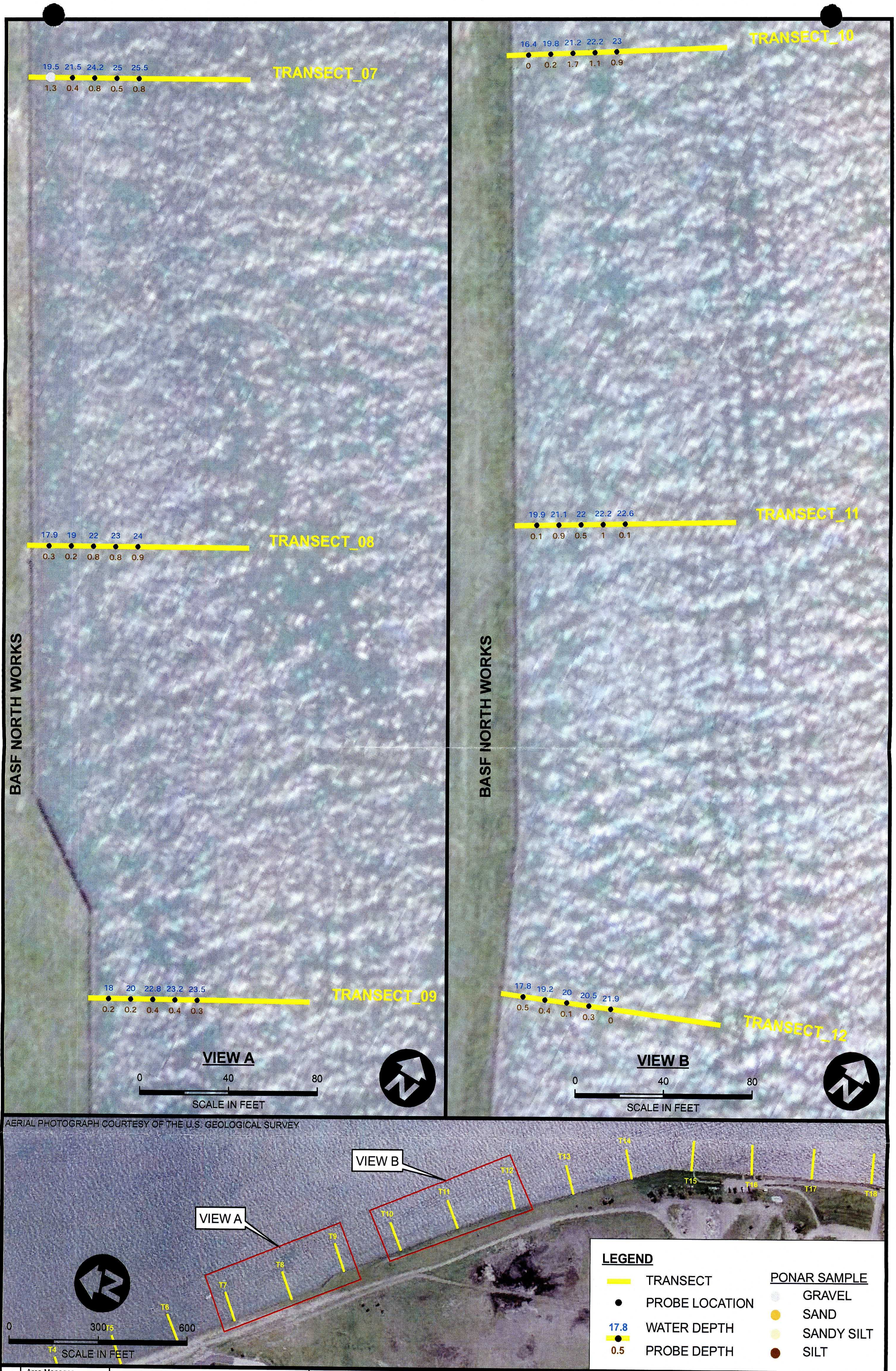

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PROBING LOCATIONS
TRANSECTS 07-09 AND 10-12
NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
TECHNICAL MEMORANDUM

WYANDOTTE, MICHIGAN

Project Number	BO042929.00.10
Date	07-SEP-2007
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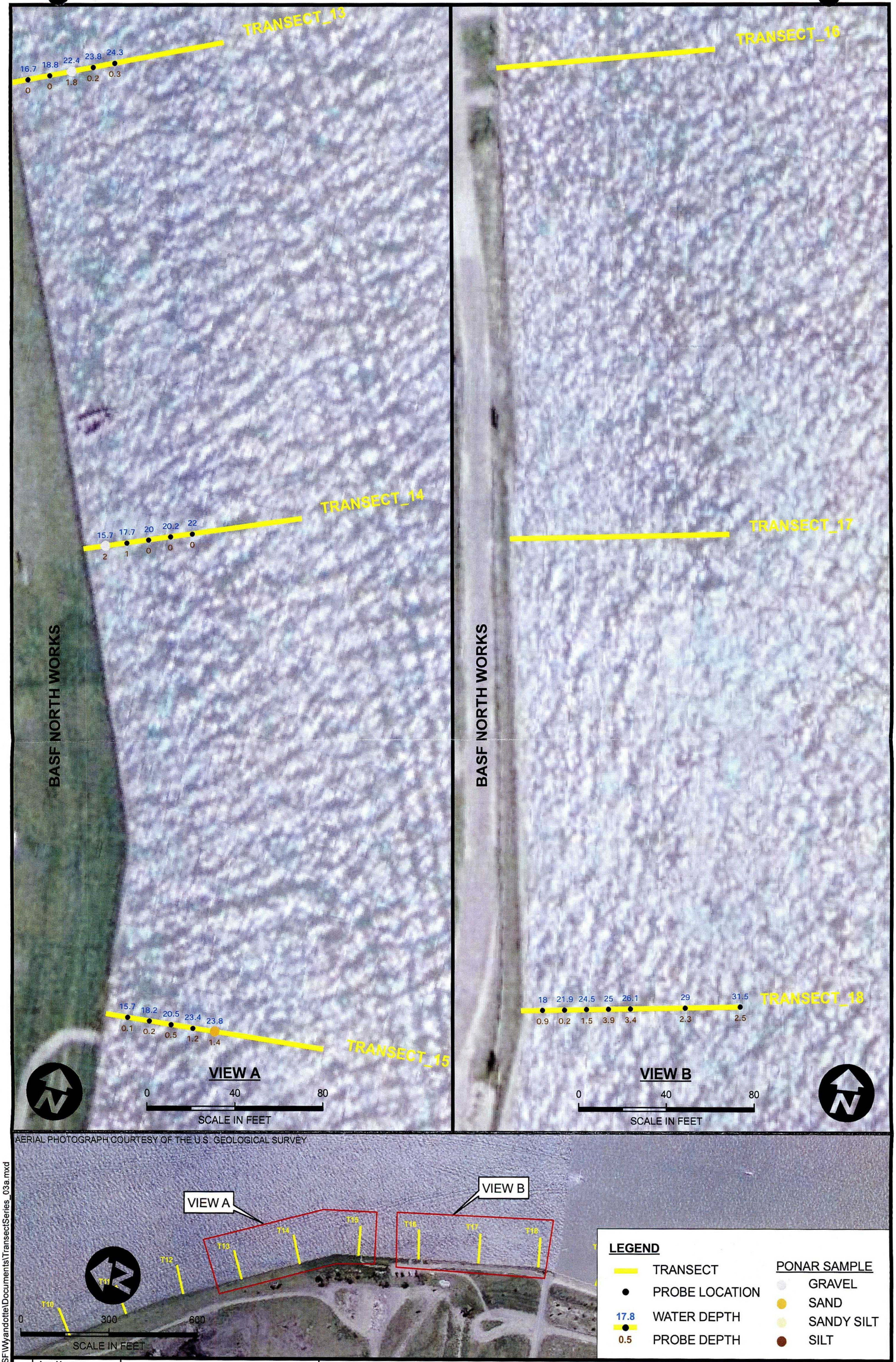

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PROBING LOCATIONS
TRANSECTS 13-15 AND 16-18
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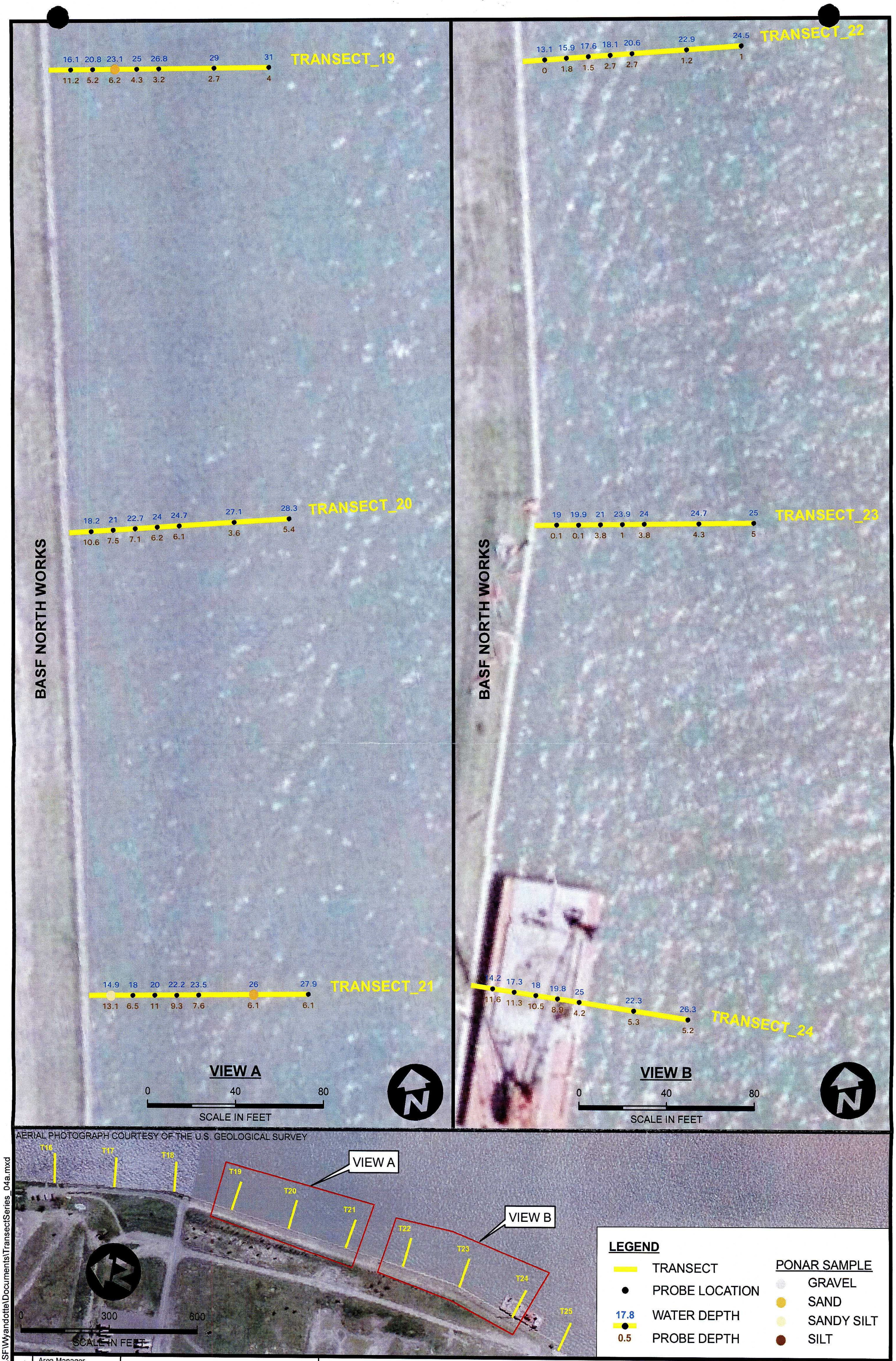

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PROBING LOCATIONS
TRANSECTS 19-21 AND 22-24
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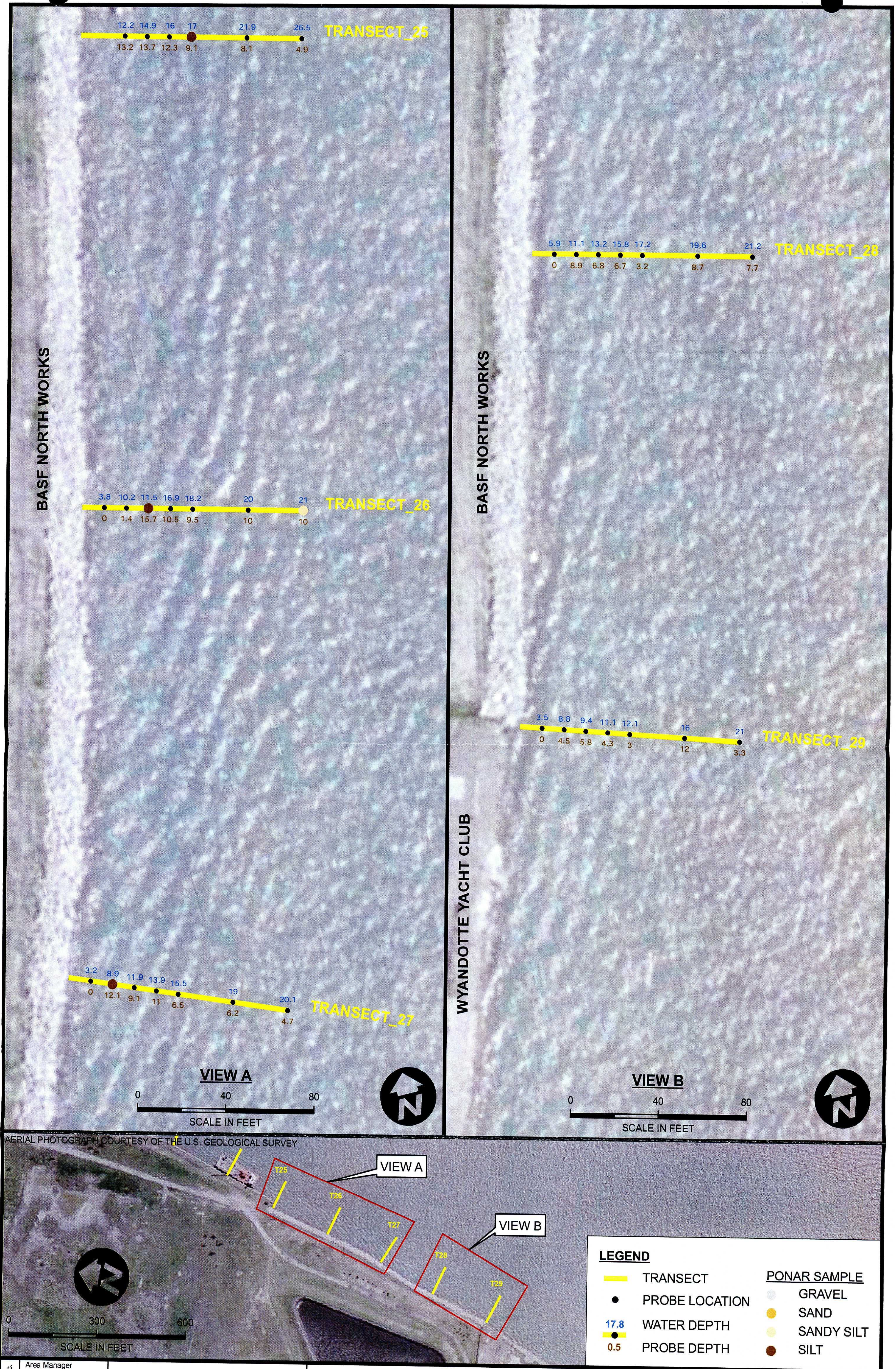

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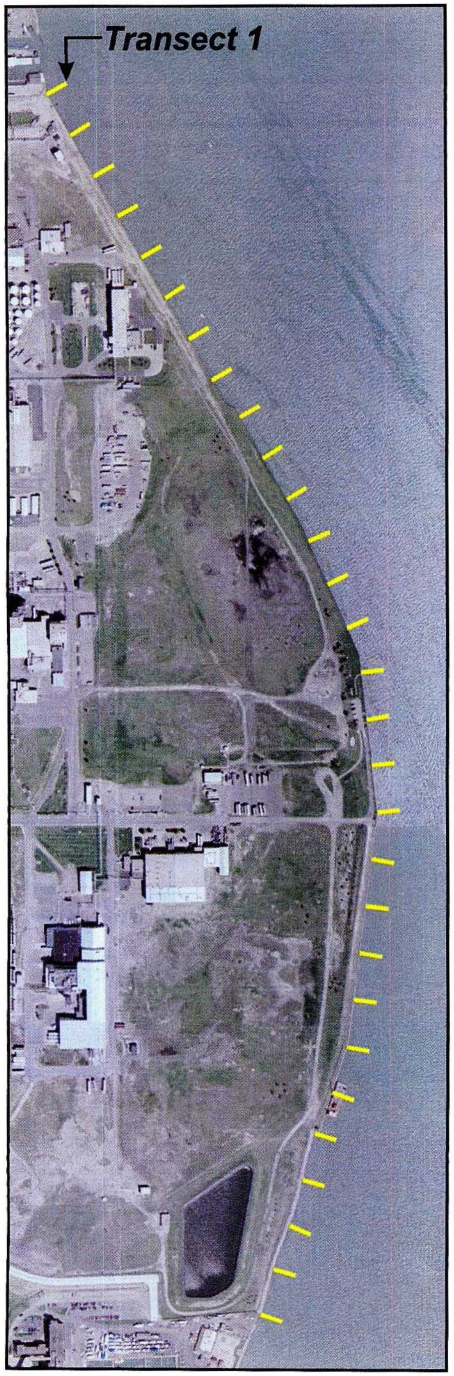
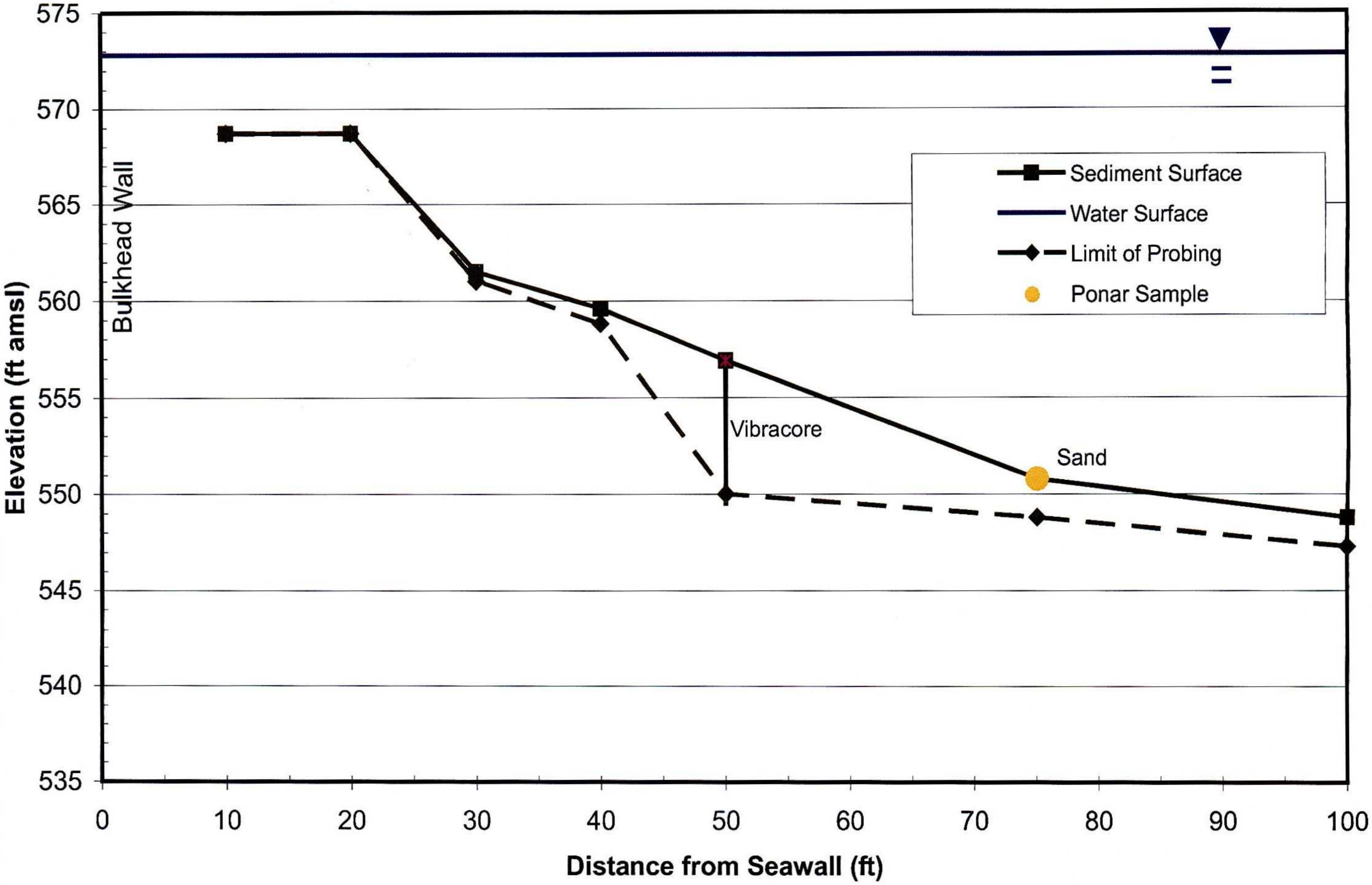




NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

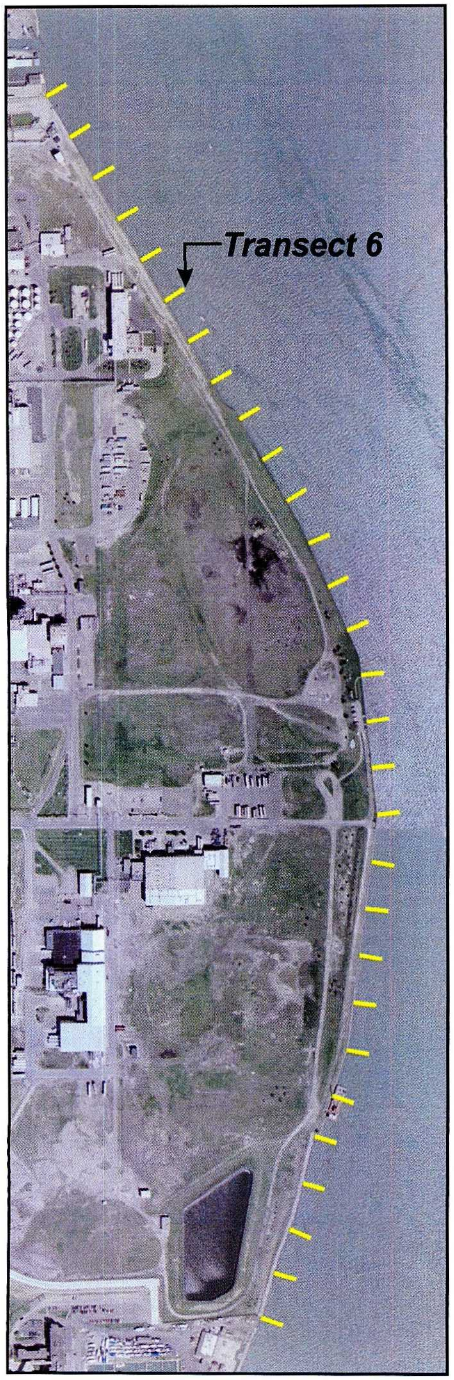
NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
BASF CORPORATION
WYANDOTTE, MICHIGAN
TECHNICAL MEMORANDUM

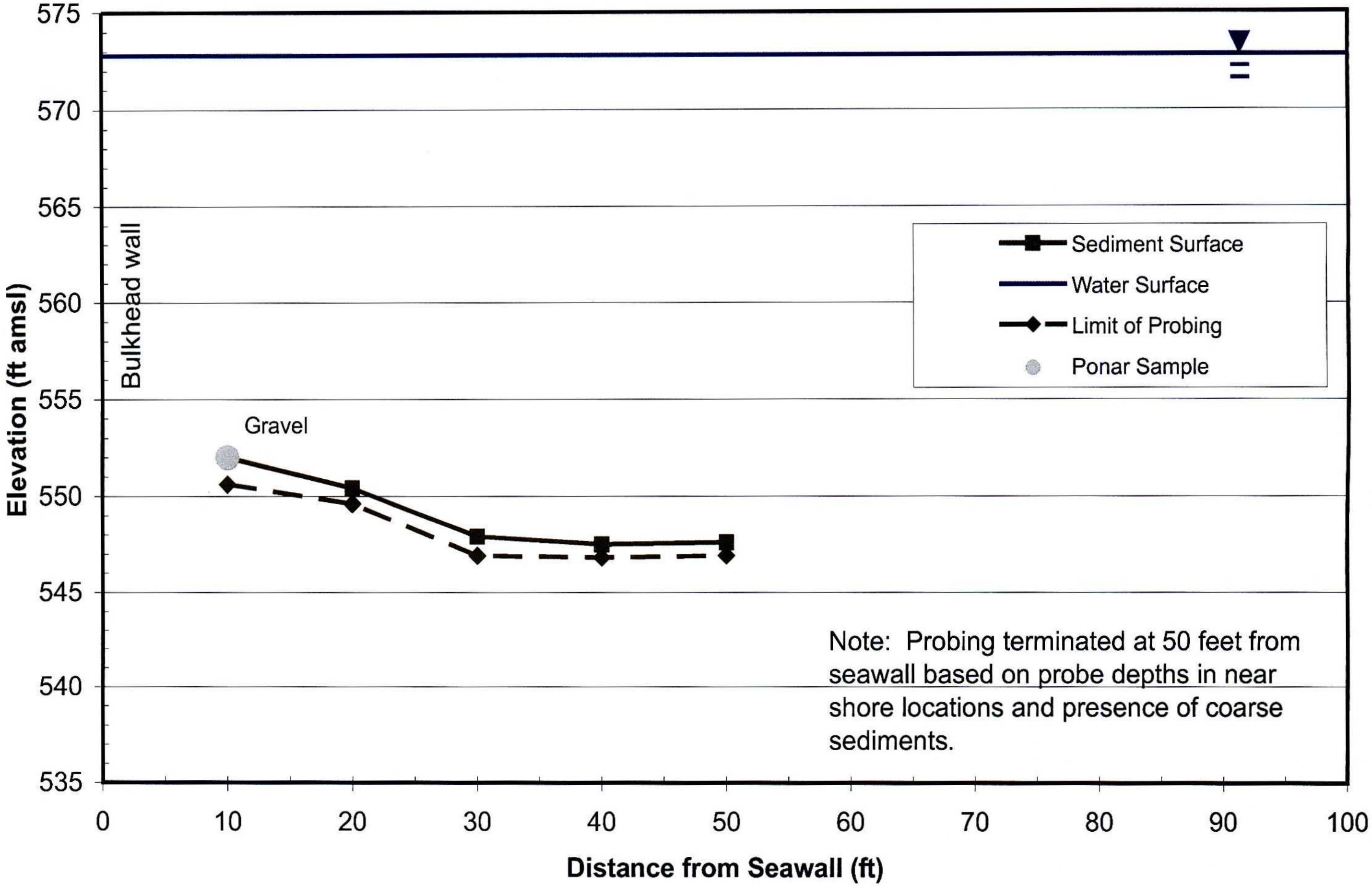
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 1

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 7

09/06/07 SYR-D85-DJH
42929010/42929G02.CDR





NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

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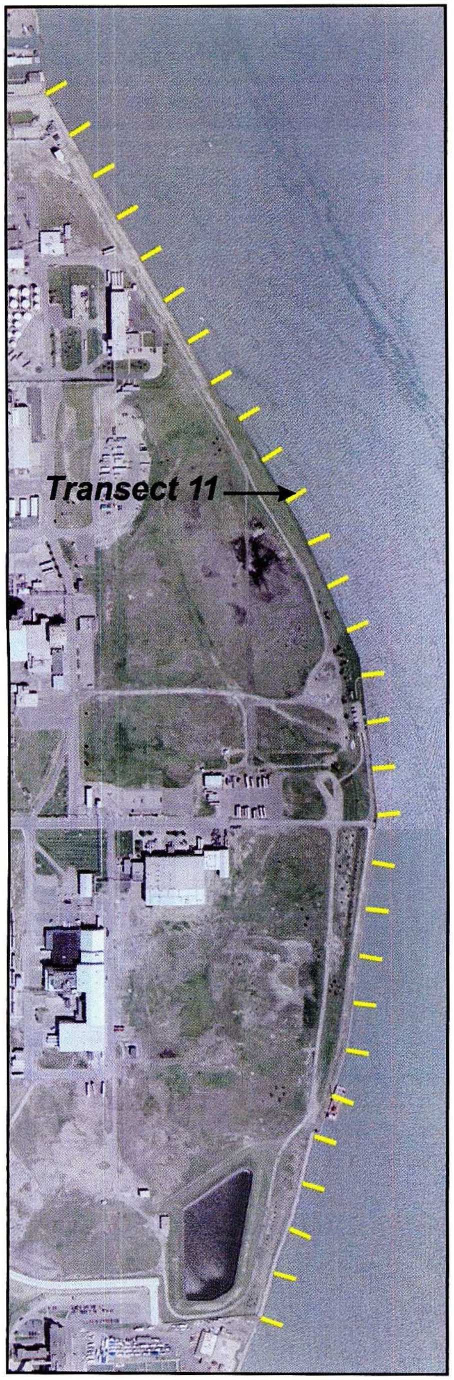
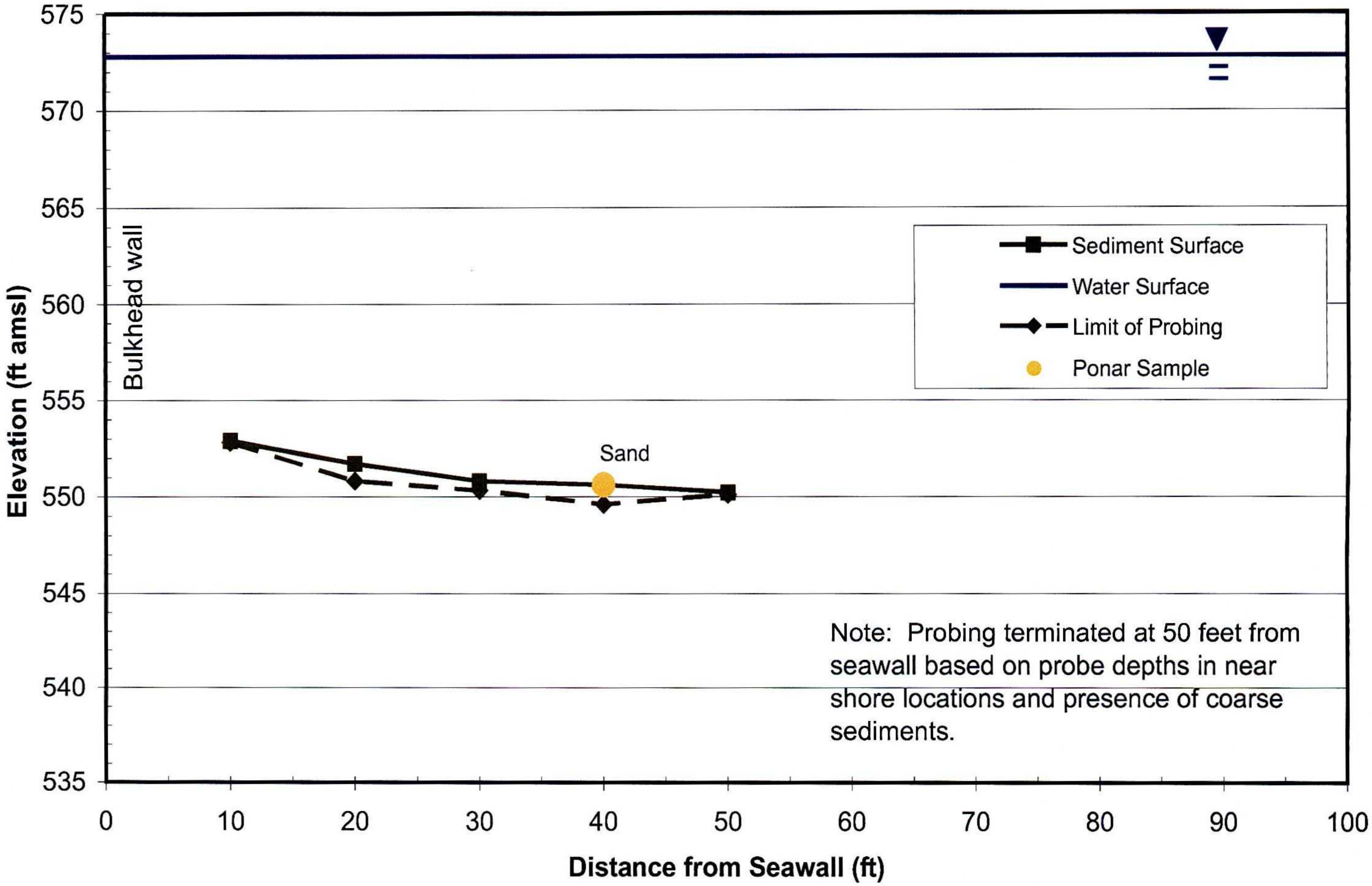
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 6

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 8

09/06/07 SYR-D85-DJH
42929010/42929G03.CDR





NOTE:
1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

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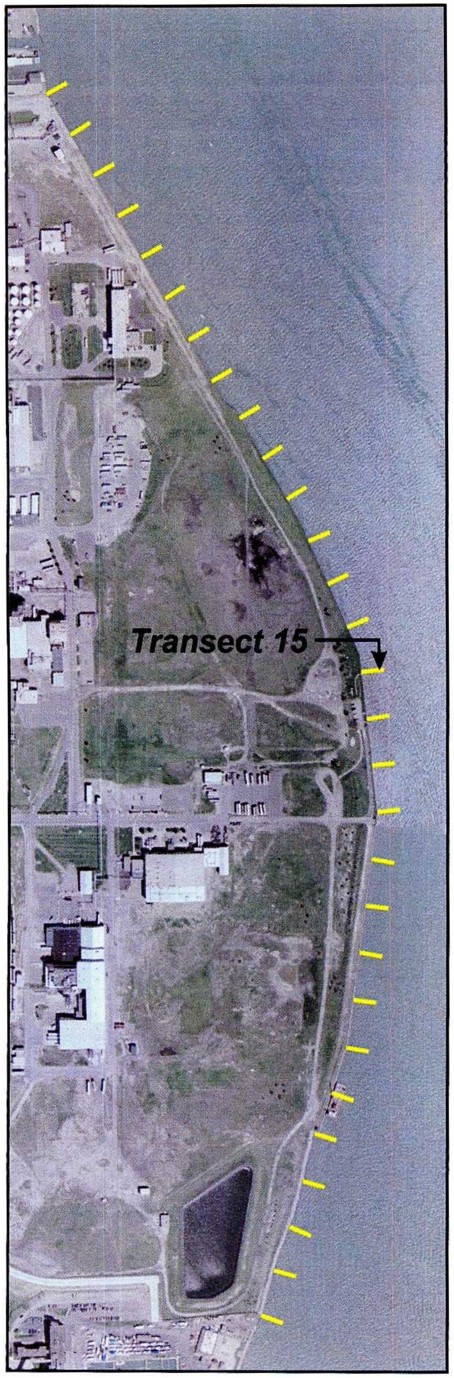
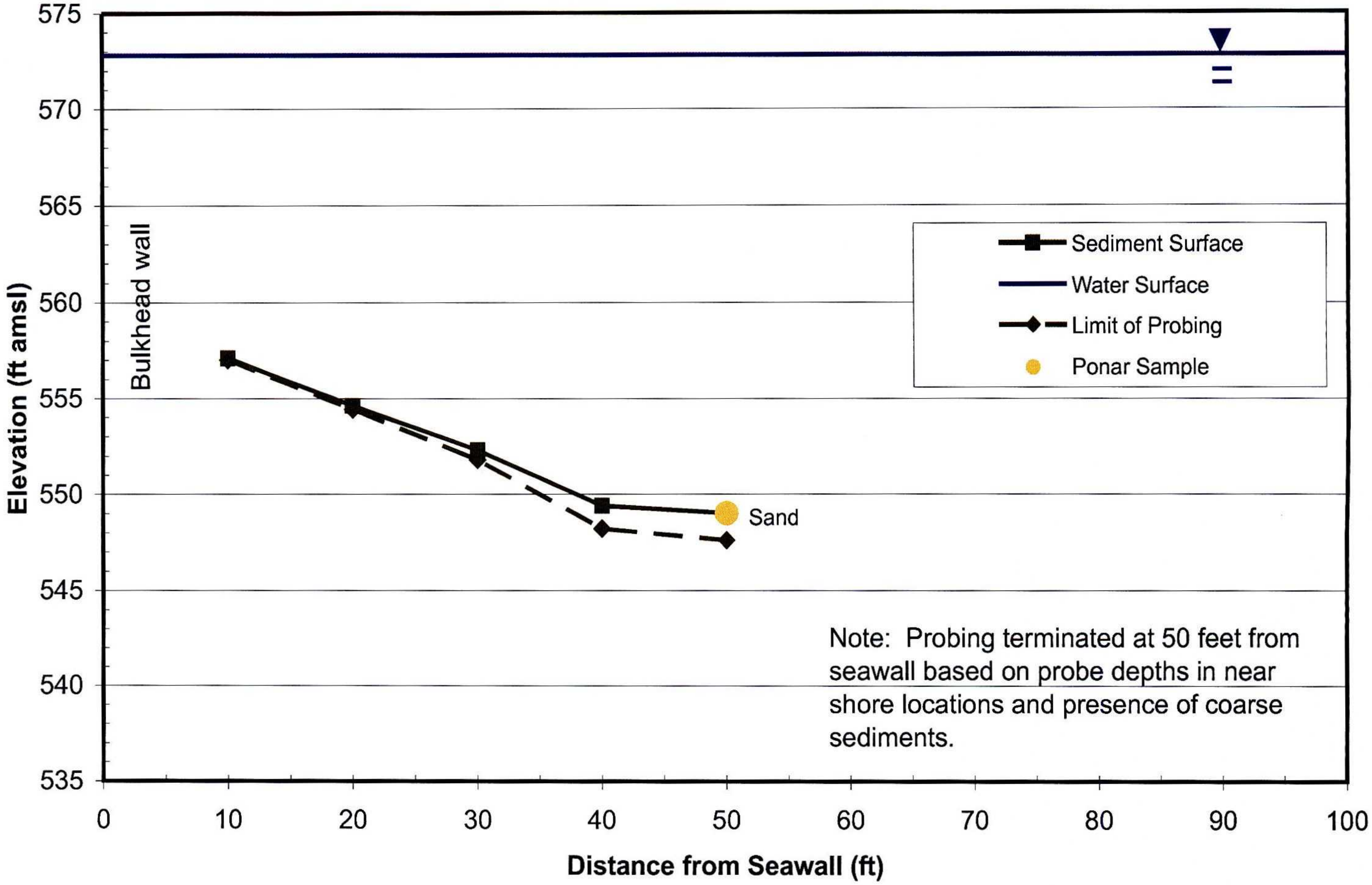
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 11

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 9

09/06/07 SYR-D85-DJH
42929010/42929G04.CDR





NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

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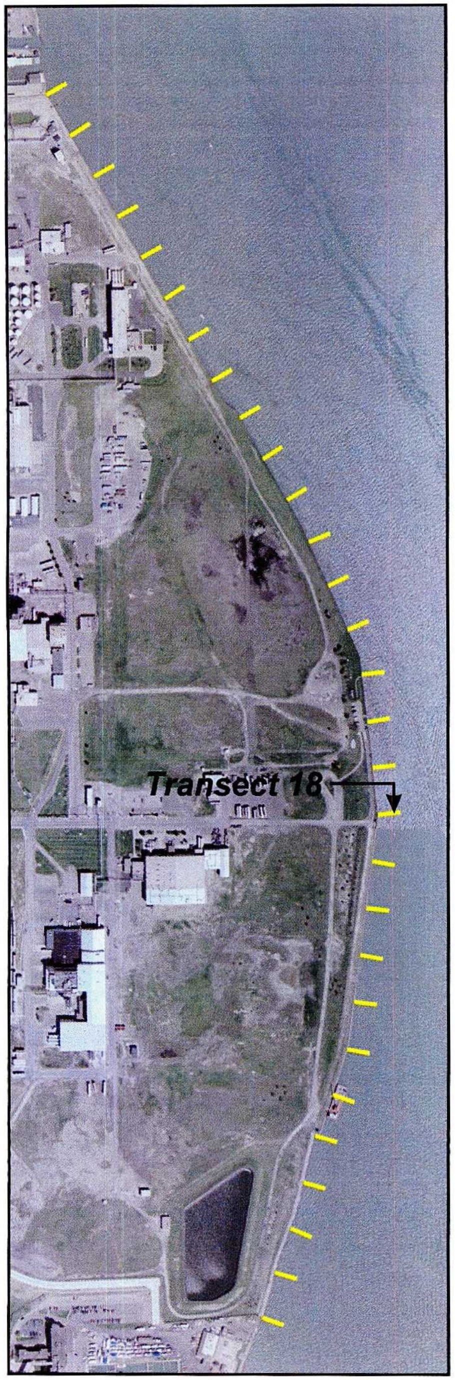
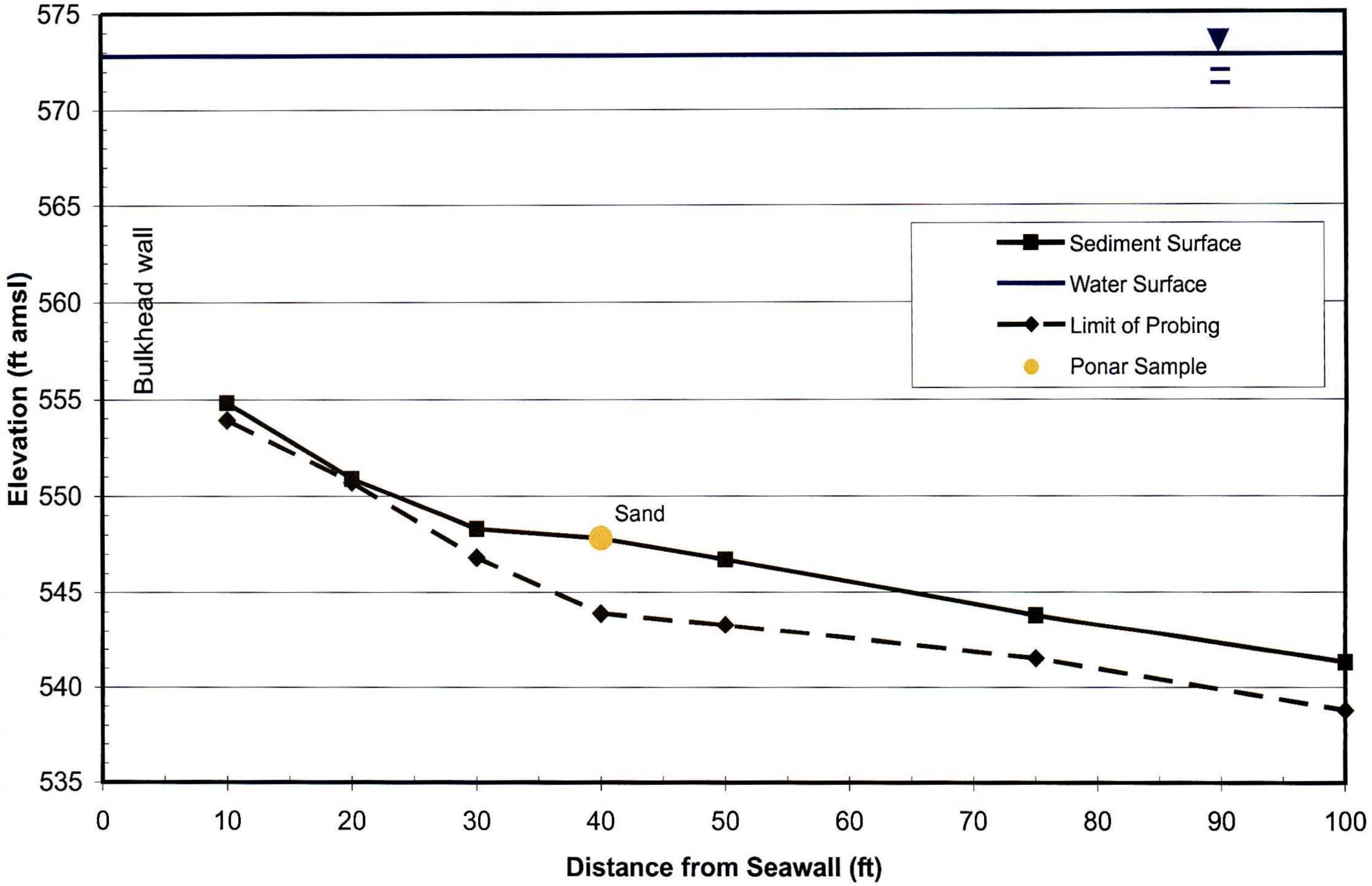
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 15

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 10

09/06/07 SYR-D85-DJH
42929010/42929G05.CDR





NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

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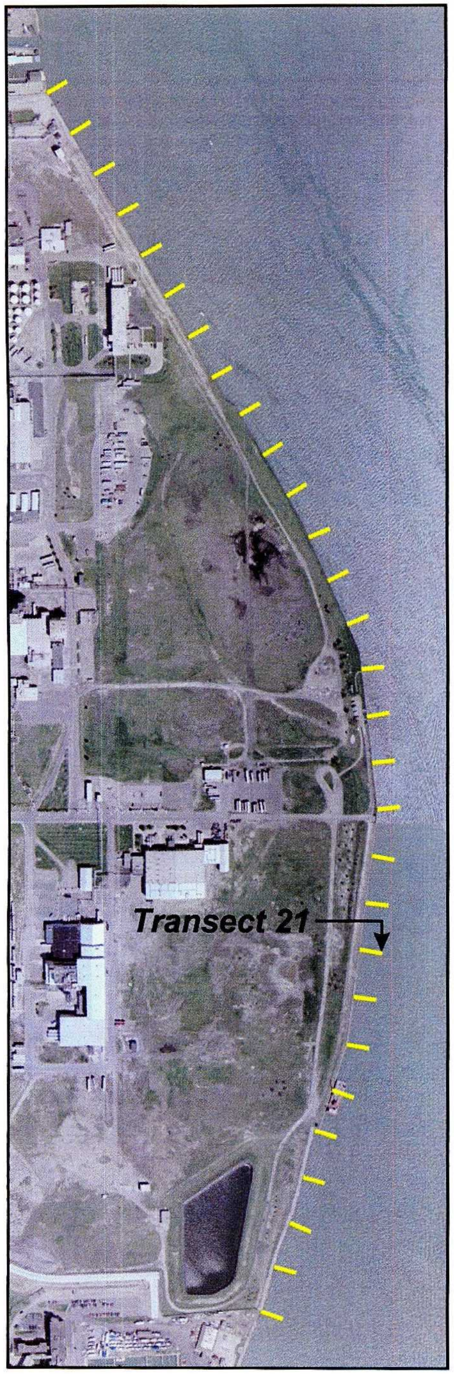
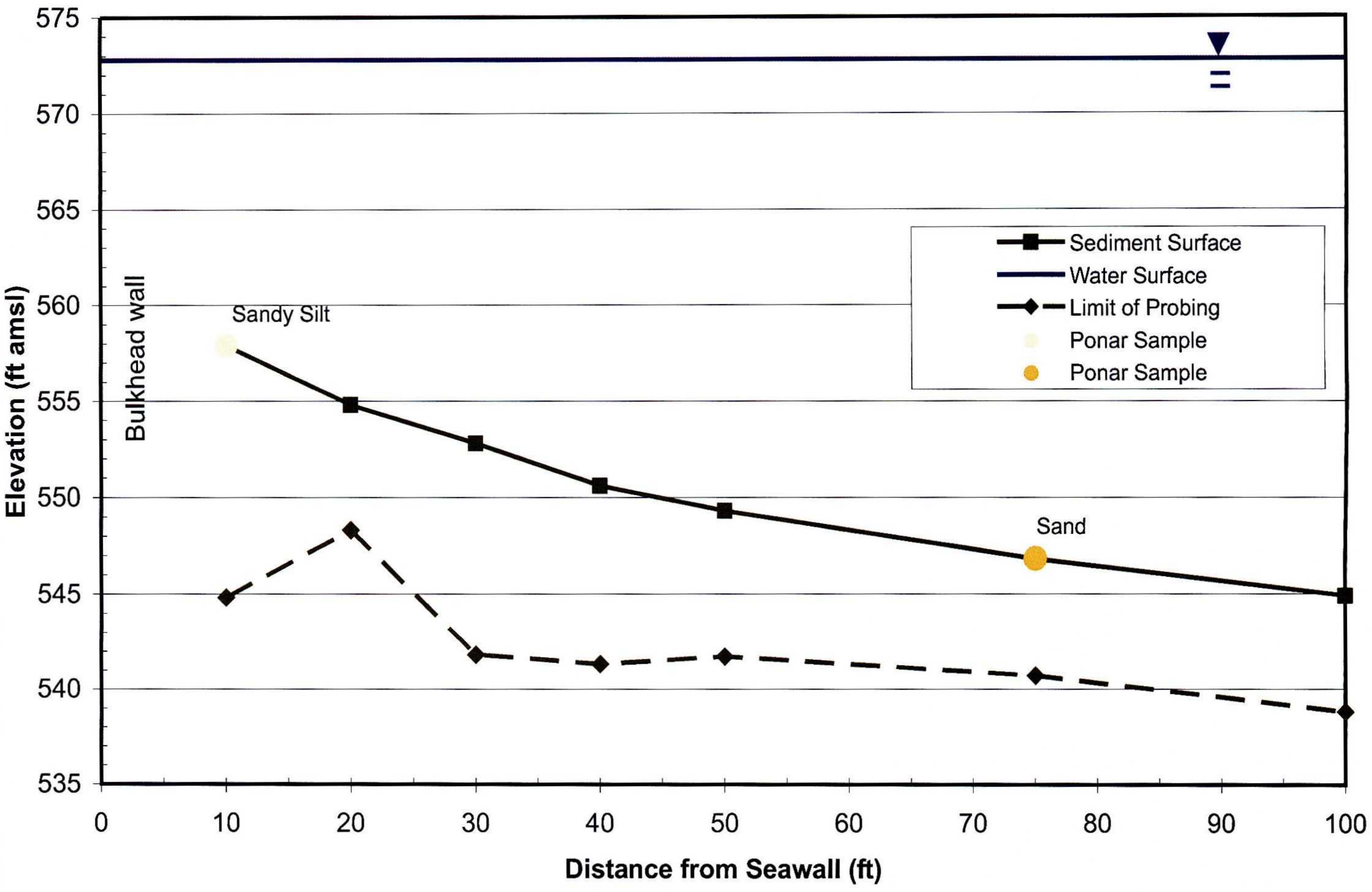
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 18

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 11

09/06/07 SYR-D85-DJH
42929010/42929G06.CDR





NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
BASF CORPORATION
WYANDOTTE, MICHIGAN
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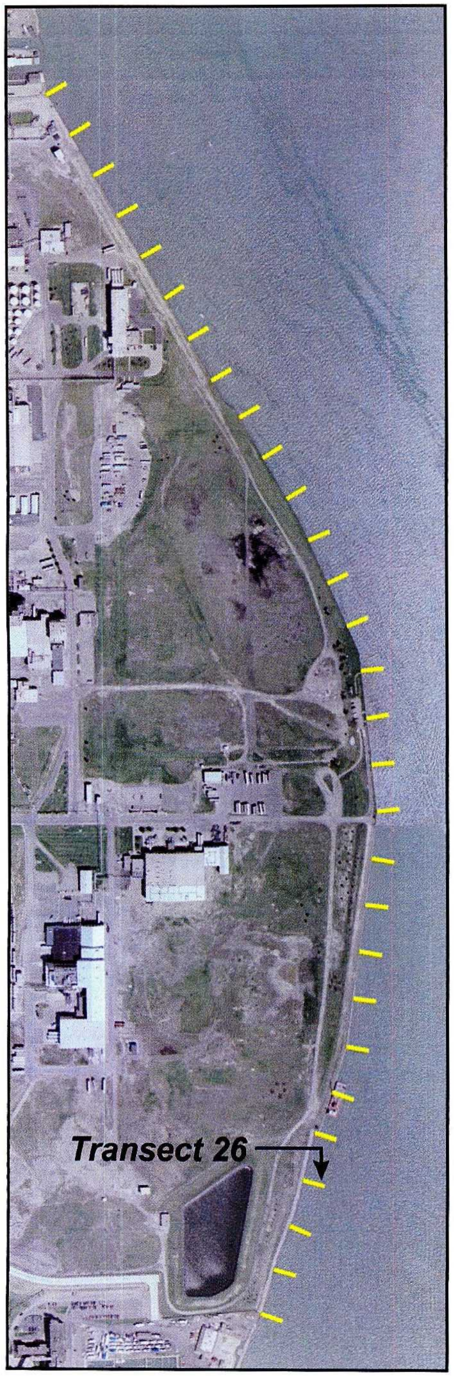
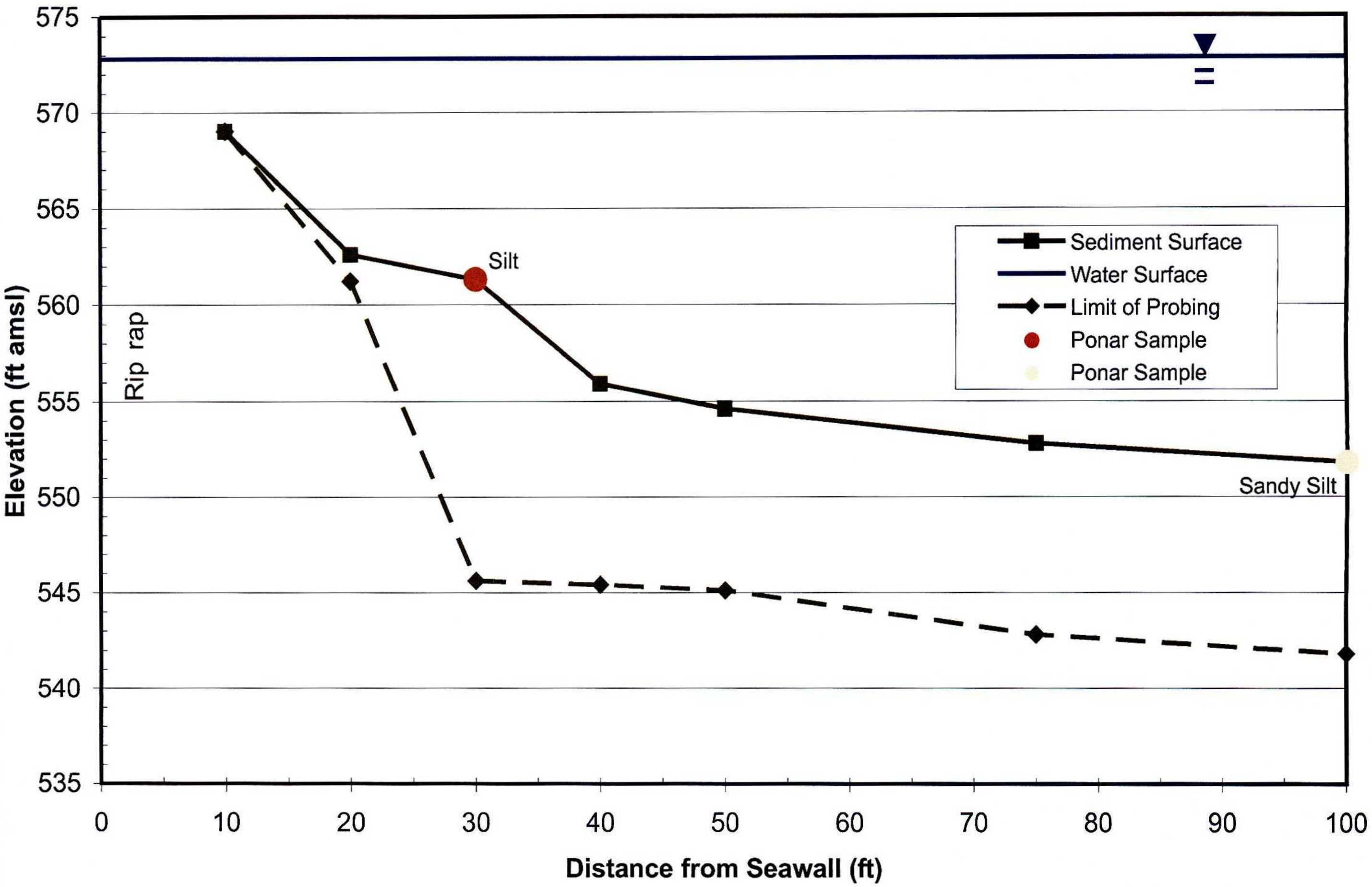
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 21

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 12

09/24/07 SYR-D85-DJH
42929010/42929G07.CDR





NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
BASF CORPORATION
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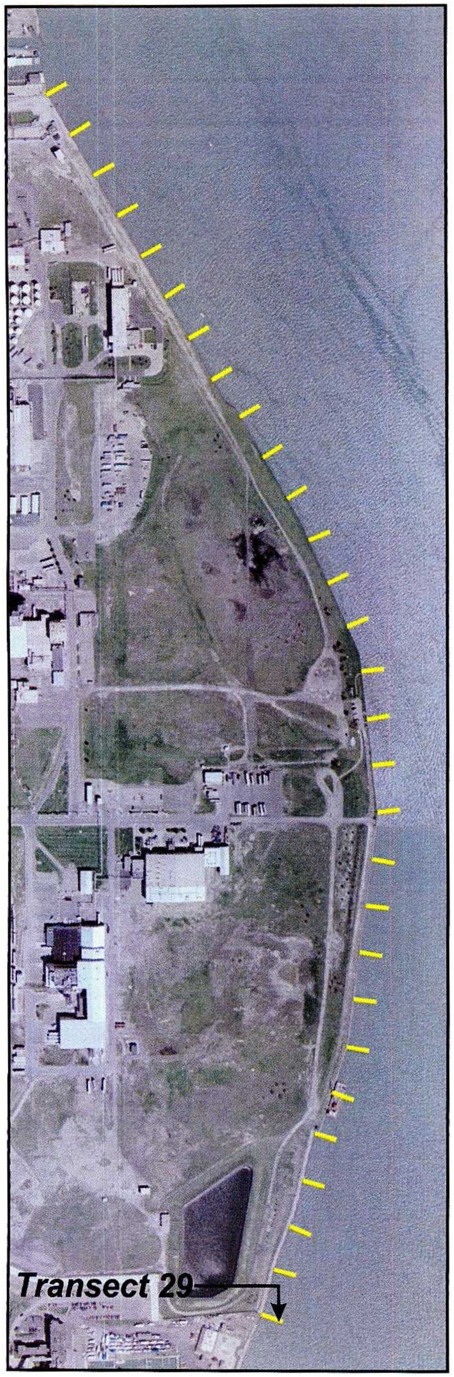
TECHNICAL MEMORANDUM

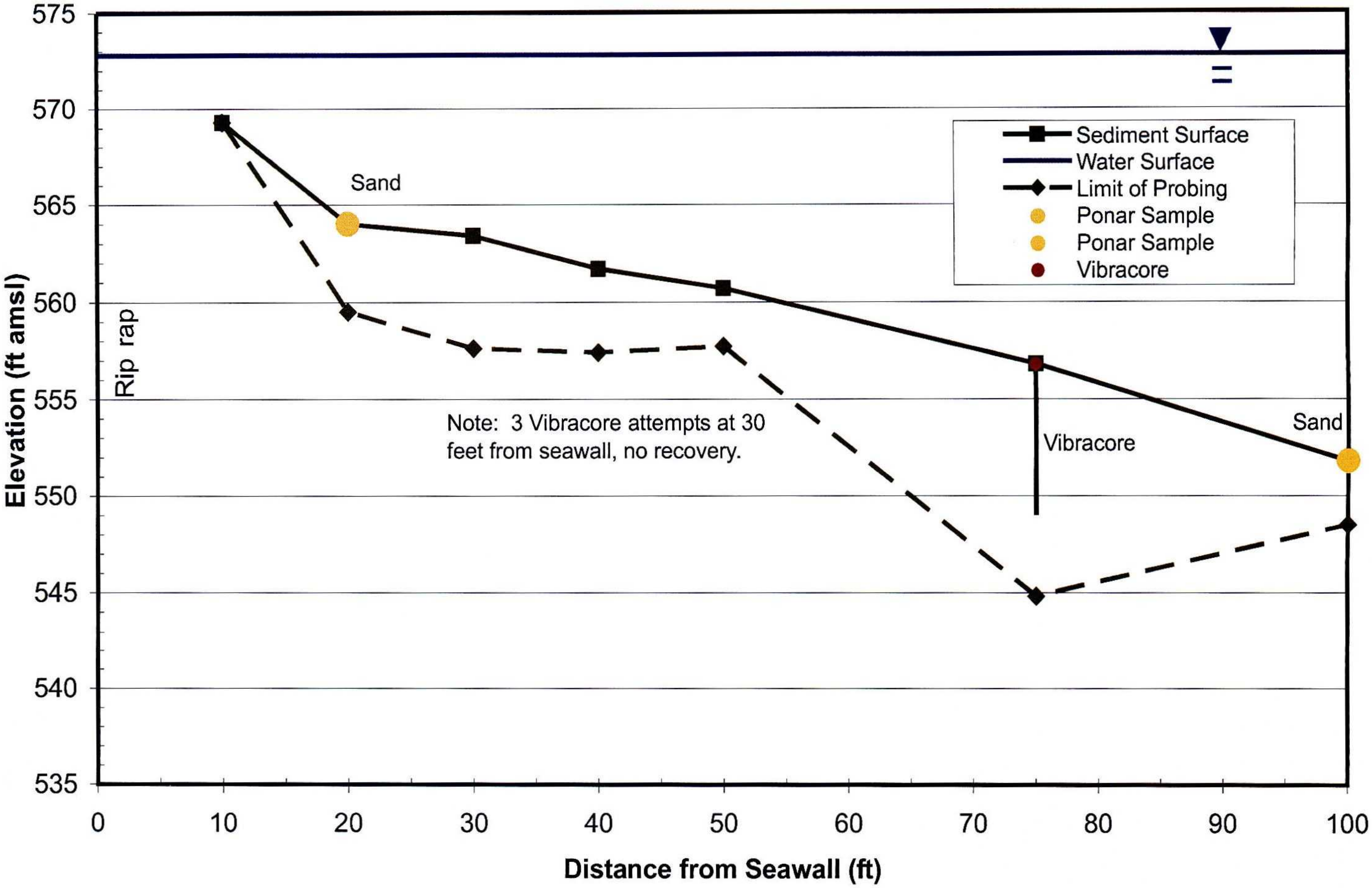
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 26

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 13

09/24/07 SYR-D85-DJH
42929010/42929G08.CDR





NOTE:

1. Water level data from NOAA Gage #9044030 in Wyandotte, MI based on IGLD85

NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
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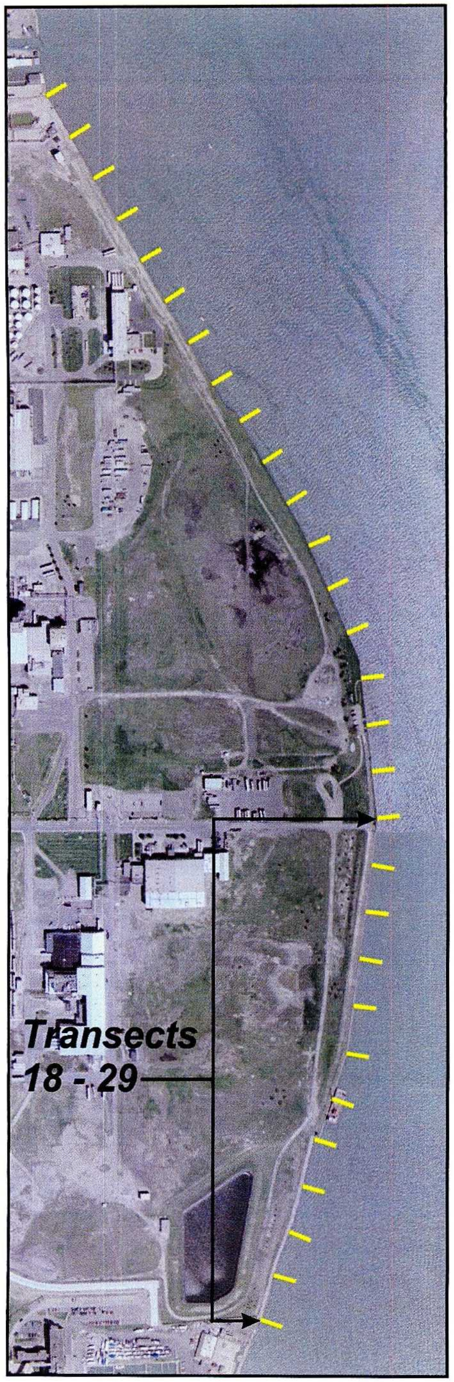
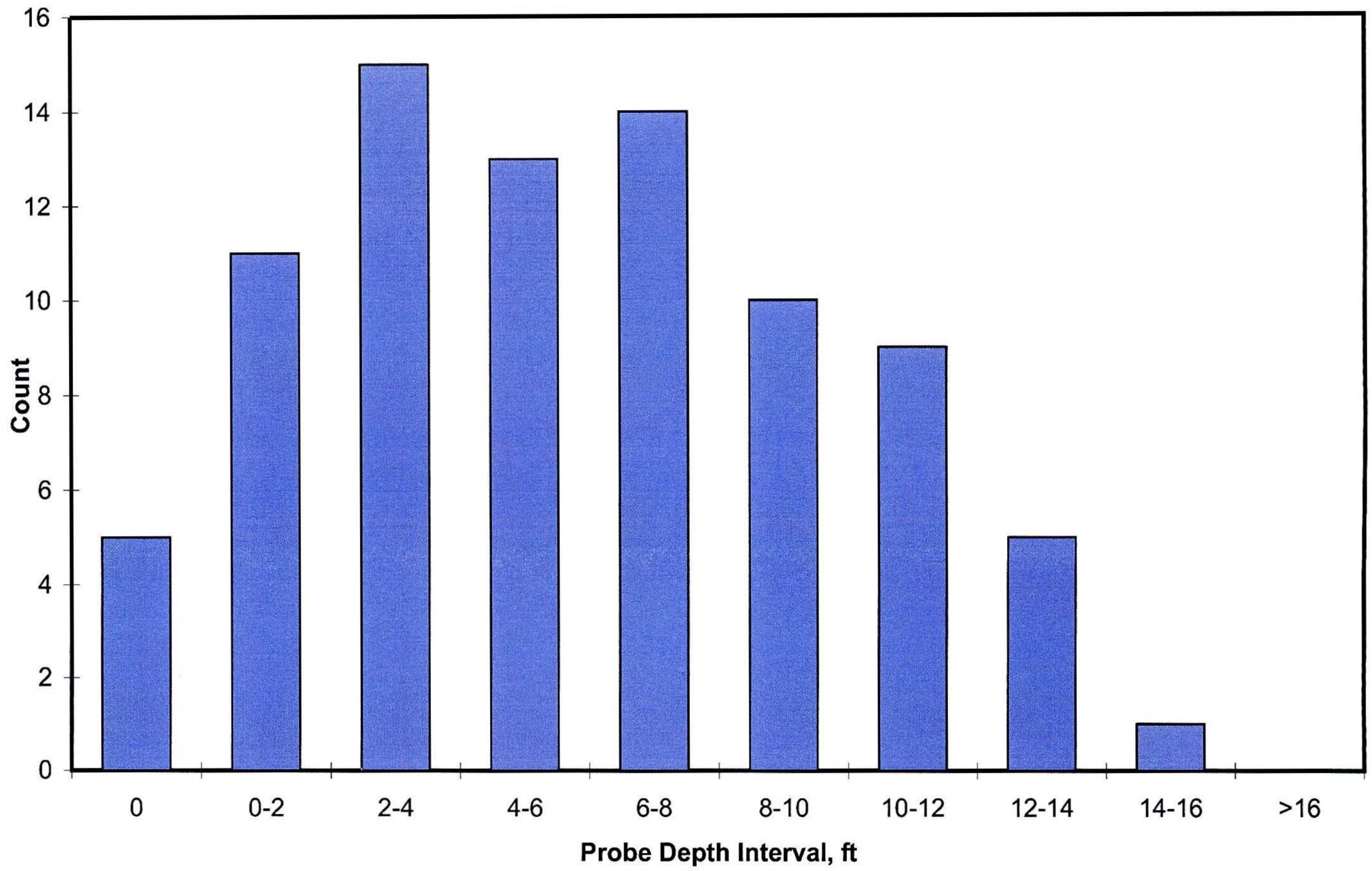
SEDIMENT PROFILE AT NORTH WORKS - TRANSECT 29

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE 14

09/10/07 SYR-D85-DJH
42929010/42929G09.CDR





NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
BASF CORPORATION
WYANDOTTE, MICHIGAN
TECHNICAL MEMORANDUM

PROBE DEPTH HISTOGRAM - TRANSECT 18 TO TRANSECT 29 AT NORTH WORKS

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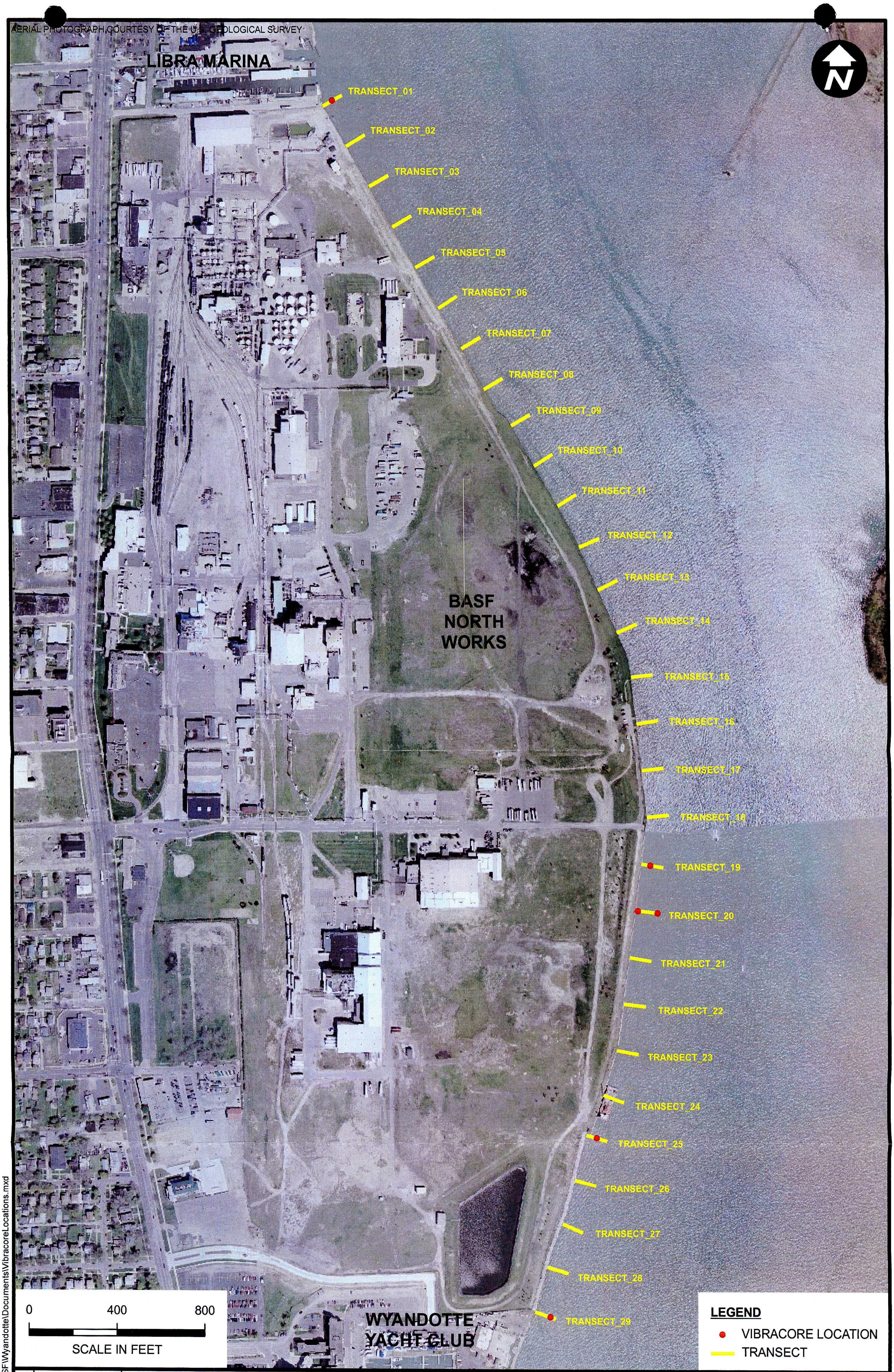
FIGURE 15



G:\ENGIS\Project Files\BASF\Wyandotte\Documents\VibracoreLocations.mxd

Area Manager	J. REID
Project Director	Michael Erickson
Task Manager	Tom Wharton
Technical Review	
Technical Review	

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www.arcadis-us.com

BASF CORPORATION

VIBRACORE LOCATIONS
NORTH WORKS SEDIMENT PROBING STUDY AUGUST 2007
TECHNICAL MEMORANDUM

WYANDOTTE, MICHIGAN

Project Number: BO042929.00.10

Date: 07-SEP-2007

Figure Number: 16

ARCADIS BBL

Appendix A

Work Scope and Approval Correspondence

ARCADIS BBL

ARCADIS G&M of Michigan, LLC
10559 Citation Drive
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Brighton
Michigan 48116
Tel 810.229.8594
Fax 810.229.8837

MEMO

To:
Juan Thomas, USEPA RPM

Copies:
Michael Gerdenich, BASF
Brian Diepeveen, BASF
Randy Ellis, ENSR
Richard Conforti, MDEQ

From:
Michael J. Erickson, P.E. ARCADIS BBL

Date:
July 13, 2007

ARCADIS BBL Project No.:
B0042929

Subject:
Sediment Probing Study Data Quality Objectives and Work Scope
BASF North Works
BASF Corporation, Wyandotte, Michigan

On behalf of BASF Corporation (BASF), ARCADIS BBL has prepared this work scope with associated Data Quality Objectives (DQOs) for a sediment probing study requested by the U.S. Environmental Protection Agency (USEPA) for the BASF North Works facility in Wyandotte, Michigan (the Site).

Background

In an undated letter received by BASF on June 15, 2006, the United States Environmental Protection Agency (USEPA) communicated the following expectations for BASF for completion of the Corrective Measures Study (CMS) for the BASF North Works property located in Wyandotte, MI (the Site):

- A "map of navigational channel that may establish whether the area adjacent to the river is a depositional area"; and
- "An evaluation of sediments that first verifies the presence/absence of sediment and if present, collect samples adjacent to the site as well as upstream and downstream to characterize sediment quality relative to background. Sediments would be analyzed for constituents including mercury."

Following this request from the USEPA, ARCADIS BBL on behalf of BASF completed a review of sedimentation conditions in the Trenton Channel near BASF North Works (*Review of Sediment Conditions in the Trenton Channel near BASF North Works,* ARCADIS BBL, November 2006). The review concluded that the upper Trenton Channel near North Works generally is not a depositional area. The available data that were reviewed suggest that any soft sediments potentially present along North Works are part of continuum of broadly impacted sediments extending downstream into the Trenton Channel from numerous upstream sources. Based on flow patterns and the general industrial history of upstream areas, historical contributions to sediment contamination in these areas are expected to be highly commingled due to the history of the area and transport dynamics in the Trenton Channel. Sediment mercury data reflect similar concentrations in nearby sediment samples downstream and upstream of North Works.

BASF representatives and the USEPA met in Chicago, IL on February 27, 2007 to discuss the CMS and the USEPA requested that BASF collect field data to provide additional information on the presence or absence of any appreciable quantities of soft sediment adjacent to the shoreline. Subsequently, a proposed work plan provided by BASF was discussed in a teleconference among USEPA, MDEQ, and BASF representatives on June 29, 2007. The proposed work plan included a combination of sediment probing and core collection along 11 transects with a greater focus on the downstream end of the site shoreline. During the teleconference, USEPA requested that BASF revised the work plan to focus on collecting probing data along transects spaced at 200 foot intervals to provide additional coverage.

This sediment probing study work plan provides for collection of the probing data requested by USEPA.

Sediment Probing Study Data Quality Objectives (DQOs)

The primary objective of the study is to evaluate the presence or absence of soft, fine-grained sediments in the Trenton Channel adjacent to BASF North Works in order to determine whether any further investigation of sediments is warranted. This determination will be made primarily based on the amount of and locations of fine-grained sediment encountered. A soft sediment threshold thickness of one foot or greater is adopted for purposes of this determination.

Water depth and total depth to bottom of probe-able sediments at probing locations are needed to evaluate if soft sediments are present and its thickness. Surface sediment samples for visual assessment are needed to classify sediment type at probing locations.

Sediment core samples will be useful to visually evaluate characteristics of the sediment column, and to what extent probe data represent accumulated sediments versus sediments and possible underlying native materials (e.g. clays, such as encountered by sediment probing and coring in downstream areas in the Trenton Channel).

A discussion of the seven steps completed to develop DQOs, following USEPA's DQO process are presented in Table 1.

Sediment Probing Study Scope of Work

- Perform sediment probing from a work boat along transects perpendicular to the North Works shoreline spaced at approximately 200-foot intervals from the upstream property line to the downstream property line as shown in Figure 1.

- The first sample in each transect will be taken as close to shore as possible, with samples taken at 10 foot intervals out to 50 feet from shore. Additional samples will be taken at 75 and 100 feet from shore only if significant amounts fine-grained sediments are found in the first 50 feet of each transect.

- At each location, record water depth, total sediment probing depth (using a hand-driven 3/8-inch metal rod and/or a water jet probe), and coordinates using Realtime Kinematic Global Positioning System (RTK GPS) equipment.

- At select locations, collect surface soft sediment grab samples using a Ponar dredge (or similar sampler) for photos and visual classification to provide a set of visual classification and photos representative of types of sediment encountered along the Site.

- Prepare a plan-view figure showing the water depth values at probing locations.

- Prepare a plan-view figure showing the sediment thickness values at probing locations.

- Prepare transect cross-section figures for selected transects if appreciable amounts of sediment are encountered, and to illustrate bathymetric cross sections.

- Obtain up to 10 core samples in areas where sediment depth based on probing exceeds 1.5 feet. Cores will be taken using a Vibracore. Each core will be labeled to indicate the location, date, visual observation log and project identification number. Representative photographs will be taken of the cores, and sections will be inspected and photographed to describe stratigraphy.

- All probing and sampling activities will be completed from a work boat with a minimum of two people on board following appropriate health and safety protocol. A health and safety plan (HASP) will be used to guide field work safety procedures.

Reporting

Following completion of the sediment probing activities, a field data summary report will be prepared and submitted to the USEPA. The report will include field logs, a summary of visual observations, photographs of samples, figures showing probe locations and results, and probe location coordinates. The report will also include a discussion of results and recommendations.

Project Schedule

BASF will initiate field activities upon receipt of USEPA acceptance of the proposed scope of work. Field activities will be completed following submittal of the final Work Plan. The report will be provided to the USEPA within 45 days following completion of the field work.

Table 1
Sediment Probing Study Data Quality Objectives (DQOs)

Major Steps	Questions to Consider	Site Information
Step 1: State the problem.	Identify leader and members of planning team.	The members of the planning team include the U.S. Environmental Protection Agency (USEPA) and the Michigan Department of Environmental Quality (MDEQ) Project Managers, the BASF project manager, the ARCADIS BBL Project Manager, and staff from USEPA GLNPO.
	Develop a conceptual model of the problem.	Bathymetric charts, velocity measurements, modeling results and other information suggests the Trenton Channel adjacent to North Works is a non-depositional area lacking significant accumulation of soft sediments. Most of the shoreline is bulk headed with shear banks and deep water. Sediments have been observed very near shore downstream could be present in certain areas along the Site.
	Develop a concise description of the problem.	No sediment sampling information concerning presence of soft sediment in the along the North Works shoreline exists. Sediment investigation to evaluate the presence or absence of soft sediments is needed.
	Specify available resources and relevant deadlines for the study.	Resources needed to complete the study are available to complete the field program in Summer 2007 (goal is completion in August).
Step 2: Identify the goals of the study.	Identify principal study questions.	The primary objective of the study is to evaluate the presence or absence of soft, fine-grained sediments in the Trenton Channel adjacent to BASF North Works in order to determine whether any further investigation of sediments is warranted.
	Define alternative actions.	Utilize existing information on depositional characteristics of the upper Trenton Channel as basis for decisions concerning the further assessment.
	Develop decision statement.	If the sediment probing study results indicate presence of soft sediments, these data will be utilized to decide if and what type of additional data to characterize sediments is warranted.
Step 3: Identify information inputs.	Identify types and sources of information needed to resolve decisions.	Sediment probing data and samples to classify sediment texture and type along transects perpendicular to the BASF North Works shoreline extending out into the channel from edge of water.

Major Steps	Questions to Consider	Site Information
	Identify the basis of information that will guide or support choices to be made later in the DQO process.	Thickness of sediment determined by probe penetration. Water depth will also be measured to permit development of bathymetric cross-sections. Physical texture/type logging and photographs for a portion of the samples.
	Select appropriate sampling and analysis methods for generating the information.	Probing will be conducted with a manually-driven steel rod or water jet probe. Surface sediment samples will be collected with a Ponar dredge or equivalent. Sediment core samples may also be collected for select locations to verify probing results and provide visual texture information.
Step 4: Define the boundaries of the study.	Define the target of interest and its relevant spatial boundaries.	The area of interest is the shoreline along BASF North Works from approximate edge of water out to a distance of approximately 100 feet from shore.
	Definition of sampling unit.	Transect oriented perpendicular to the shoreline with up to 8 stations per transect. If significant sediments are not observed within 50 feet from shore, sampling in the transect will cease at 50 feet.
	Specify temporal boundaries and other practical constraints with sample/data collection.	Practical constraints include water depths, velocities, and sediment characteristics. Collection of samples in rocky or debris-filled areas may be difficult. The field effort is expected to be completed within one week.
	Specify the smallest unit on which decisions or estimates will be made.	Individual probe locations.
Step 5: Develop the analytic approach.	Specify appropriate population parameters for making decisions or estimates.	Percentage of probe locations indicating appreciable quantities of soft sediment (e.g. soft sediment thickness greater than one foot). Distance from shore soft sediments are observed. Classification of sediment types received.
	Define a workable action level for decision problems.	This will be a subjective determination based on overall evaluation of the results.

Major Steps	Questions to Consider	Site Information
Step 6: Specify performance or acceptance criteria.	Determine the possible range of the parameter of interest	A possible range of zero to 10 feet of sediment is assumed.
	Determine the impact of decision errors.	If a false determination of lack of soft, fine-grained sediment present at sufficient amounts to warrant further investigation, inaccurate conclusions concerning sediments could be.
	Specify the range of possible values of the parameter of interest where the consequences of decision errors are relatively minor.	There is a low potential for erroneous conclusions given the high spatial frequency of measurements being conducted and the direct measurement of soft-sediment thickness provided by probing measurements. The visual inspection of sediments will provide direct observation of sediment type (e.g. "muddy" versus sandy sediment) to further support for conclusions with low potential for error.
	Set tolerable decision limits.	It is unlikely that the number of samples taken from transects identified will result in the misidentification of sediments. Additionally, the likelihood of error is low due to the type of data being collected.
Step 7: Develop the sampling plan.	Review DQO outputs and existing environmental data.	Study results will be reviewed along with existing information summarized in the November 2006 report (BBL, 2006).
	Define the final sampling and analysis design, along with key underlying assumptions.	East-west transects will be set at 200 feet intervals beginning with the northern property line at North Works downstream to the southern property line. The first sample in each transect will be taken as close to shore as possible, with the next sample spaced 10 feet further into the Channel. Samples will be taken every 10 feet in this manner until a distance of 50 feet from shore is reached. Samples will then be taken every 25 feet until a distance of 100 feet from shore is obtained, at which point sampling will cease (for a total of 8 probes per transect). If significant sediments are not observed within 50 feet from shore, sampling in the transect will cease at 50 feet.

SYR-85 KEW KEW MTK
BASF (42929.005)
Q:\BASF_DetroitRiver_MI\NorthWorks\NorthWorksSedimentInvestigationWP\mxd\SedimentProbingTransectLocations.mxd - 7/13/2007 @ 1:35:54 PM

LEGEND:

T-1 PROPOSED SEDIMENT PROBING TRANSECT

BASF NORTH WORKS PROPERTY BOUNDARY

0 600 1,200 Feet

GRAPHIC SCALE

NOTE:

1. AERIAL PHOTOGRAPHY PROVIDED BY MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION.

BASF CORPORATION- WYANDOTTE, MI
NORTH WORKS
SEDIMENT PROBING WORK PLAN

PROPOSED TRANSECT LOCATIONS

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
DE-9J

July 26, 2007

Mr. Michael Gerdnich
BASF, The Chemical Company
1609 Biddle Avenue
Wyandotte, MI 48192

Re: Sediment Probing Study - North Works Plant, Scope of Work Approval

The United States Environmental Protection Agency (U.S.EPA), has completed its review of the BASF Corporation's, "Sediment Probing Study Data Quality Objectives and Scope of Work" dated July 13, 2007. The sediment probing study will take place along the Trenton Channel adjacent to the Northworks Facility. This study is being conducted in accordance with Section IX.C (Additional Work) of the February 28, 1994 3008(h) Administrative Consent Order for the BASF Corporation Facility of Wyandotte, Michigan. The primary objective of the sediment study is to initially evaluate for the presence or absence of fine-grained sediments in the Trenton Channel adjacent to the BASF Northworks facility in order to determine whether further sediment investigation is warranted. If warranted, subsequent investigation would commence, which would include chemical characterization of sediments.

Accordingly, the U.S. EPA approves of the proposed "Scope of Work" modifying only the 45 day time period to submit a "Field Data Summary Report". The U. S. EPA is requesting that this report be submitted to U.S EPA in 21 days. This task should be easily achievable given the nature of the "work scope" and the fact that there will not be any chemical analysis of sediment during this phase of the investigation. Furthermore, in the event that further investigation is warranted, this should provide the time needed to plan and execute a final phase of study during more conducive seasonal weather conditions.

The U.S. EPA expects that BASF will initiate field activities upon receipt of this approval letter. A final work plan incorporating the aforementioned "report submission time" modification can be submitted concurrently with commencement of field activities. As discussed during our telephone conference call yesterday, July 25, 2007, with representatives from BASF, EPA and the Michigan Department of Environmental Quality (MDEQ), a schedule and itinerary of field work will be provided for EPA and MDEQ. Representatives from either or both EPA and MDEQ may conduct a site visit during this time period. Based on our discussions, EPA expects that BASF will begin field work no later than August 13, 2007 and complete field work by August

17, 2007. A Field Data Summary Report" as outlined in your "Scope of Work" should be submitted to EPA no later than September 7, 2007. U.S. EPA is looking forward to continued cooperation with you. Should you have any questions or concerns, please call me at 312-886-6010.

With Thanks,

Juan Thomas, MPH
Environmental Scientist
RCRA Corrective Action Project Manager

Cc: Reginald Pallesen, C-14J (electronic copy)
Richard Conforti, MDEQ (electronic copy)
Dave Slayton, MDEQ (electronic copy)

BASF The Chemical Company

Michael J Gerdenich/NTU/WYANDOTT/BASF-CORP/BASF

07/27/2007 11:49 AM

To Thomas.Juan@epamail.epa.gov

cc "Brian W Diepeveen" <brian.diepeveen@basf.com>, confortr@michigan.gov, "David W Sheaves" <david.sheaves@basf.com>,

bcc

Subject Re: BASF - Sediment Probing Work Scope

Good Morning Juan:

BASF has reviewed your draft letter received on July 26th and has the following comments:

As discussed in our teleconference on July 24th, BASF agreed to provide the scheduled field work start date to US EPA by today. The timing is dictated by logistical factors, primarily equipment and personnel availabilities, which can be restrictive during the summer vacation season. Mike Erickson of Arcadis BBL has confirmed that the equipment and staff will be available the week of August 27th and I have asked Mike to reserve that time slot for the sediment probing effort. As discussed on the 24th, Arcadis BBL should be able to complete the work in one week.

Arcadis BBL's July 13th Sediment Probing Work Scope called for a report deliverable schedule of 45 days from completion of field work. In our call last Tuesday, US EPA asked for an expedited delivery schedule and BASF's team agreed to make a best faith effort to advance that date. No specific deadline for a final report was proposed, discussed or agreed to during the call. Please note that the 21 day window proposed in the draft letter includes the Labor Day holiday.

BASF will make every effort to supply the final report in an expedited manner (< 45 days) and BASF again extends the offer to provide data summaries to US EPA and MDEQ as the field work progresses. BASF also welcomes US EPA and MDEQ to view the probing efforts the week of August 27th.

Thank you Juan. Please call or e-mail with questions or comments. I hope you can make the trip to Wyandotte during the sediment probing efforts.

Mike

Michael Gerdenich
EHS Remediation Team Member

Phone: (734) 324-6298
Mobile: (734) 365-9573
Fax: (734) 324-6401
BASF Corporation
1609 Biddle Avenue
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BASF - The Chemical Company

Thomas.Juan@epamail.epa.gov

Thomas.Juan@epamail.epa.gov

07/26/2007

To Michael J Gerdenich <michael.gerdenich@basf.com>

cc "Brian W Diepeveen" <brian.diepeveen@basf.com>, confortr@michigan.gov, Petrovski.David@epamail.epa.gov, 03:40 PM

Wethington.David@epamail.epa.gov, "David W Sheaves" <david.sheaves@basf.com>, Petrovski.David@epamail.epa.gov, michael.erickson@arcadis-us.com, rwellis@ensr.aecom.com, "Richard Conforti" <confortr@michigan.gov>, "Delores Montgomery" <MONTGOMD@michigan.gov>, "Arthur Ostaszewski" <OSTASZEA@michigan.gov>, "David Slayton" <SLAYTOND@michigan.gov>

Subject BASF - Sediment Probing Work Scope

Mike,

The file below is our approval of the proposed work plan. Please note the one change in the time requested to submit your report. Any word on a field schedule yet? I will also mail you a signed hard copy tomorrow. Thanks.

Juan Thomas
Environmental Scientist, CA Project Manager
U.S. EPA Region 5, Land and Chemicals Division
Remediation and Reuse Branch
Corrective Action Section II
312-886-6010
(312) 353-4342 (fax)
thomas.juan@epa.gov

(See attached file: BASFsedstudy0707a.doc) BASFsedstudy0707a.doc

ARCADIS BBL

Appendix B

Probe Locations

ARCADIS
Infrastructure, environment, facilities

BASF Corporation
Wyandotte, Michigan
North Works Sediment Probing Study, August 2007

COORDINATES IN NAD MICHIGAN STATE PLANE SOUTH (FEET)			
EASTING	NORTHING	TRANSECT	DISTANCE FROM SHORE
13453865.57	266846.03	1	0
13453874.28	266850.93	1	10
13453883.00	266855.84	1	20
13453891.71	266860.74	1	30
13453900.43	266865.64	1	40
13453909.15	266870.54	1	50
13453930.94	266882.80	1	75
13453952.72	266895.06	1	100
13453971.14	266670.46	2	0
13453979.71	266675.60	2	10
13453988.29	266680.75	2	20
13453996.86	266685.89	2	30
13454005.44	266691.04	2	40
13454014.01	266696.18	2	50
13454035.45	266709.04	2	75
13454056.88	266721.91	2	100
13454075.55	266494.23	3	0
13454084.27	266499.14	3	10
13454092.98	266504.04	3	20
13454101.70	266508.94	3	30
13454110.41	266513.85	3	40
13454119.13	266518.75	3	50
13454140.92	266531.00	3	75
13454162.71	266543.26	3	100
13454180.75	266318.45	4	0
13454189.47	266323.34	4	10
13454198.19	266328.24	4	20
13454206.92	266333.13	4	30
13454215.64	266338.02	4	40
13454224.36	266342.91	4	50
13454246.17	266355.14	4	75
13454267.97	266367.36	4	100
13454285.51	266142.41	5	0
13454294.23	266147.31	5	10
13454302.94	266152.21	5	20
13454311.66	266157.11	5	30
13454320.37	266162.02	5	40
13454329.09	266166.92	5	50
13454350.88	266179.18	5	75
13454372.67	266191.43	5	100

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Infrastructure, environment, facilities

COORDINATES IN NAD MICHIGAN STATE PLANE SOUTH (FEET)			
EASTING	NORTHING	TRANSECT	DISTANCE FROM SHORE
13454389.91	265965.89	6	0
13454398.39	265971.19	6	10
13454406.87	265976.49	6	20
13454415.35	265981.79	6	30
13454423.83	265987.09	6	40
13454432.31	265992.39	6	50
13454453.51	266005.64	6	75
13454474.71	266018.89	6	100
13454493.56	265789.47	7	0
13454502.28	265794.37	7	10
13454511.00	265799.27	7	20
13454519.71	265804.18	7	30
13454528.43	265809.08	7	40
13454537.14	265813.98	7	50
13454558.93	265826.24	7	75
13454580.72	265838.49	7	100
13454596.14	265612.16	8	0
13454604.85	265617.08	8	10
13454613.55	265622.00	8	20
13454622.25	265626.93	8	30
13454630.96	265631.85	8	40
13454639.66	265636.77	8	50
13454661.42	265649.08	8	75
13454683.18	265661.39	8	100
13454719.08	265454.12	9	0
13454727.80	265459.02	9	10
13454736.52	265463.92	9	20
13454745.23	265468.83	9	30
13454753.95	265473.73	9	40
13454762.66	265478.63	9	50
13454784.45	265490.89	9	75
13454806.24	265503.15	9	100
13454823.09	265277.84	10	0
13454831.57	265283.14	10	10
13454840.05	265288.44	10	20
13454848.53	265293.74	10	30
13454857.01	265299.04	10	40
13454865.49	265304.34	10	50
13454886.69	265317.59	10	75
13454907.89	265330.84	10	100

ARCADIS

Infrastructure, environment, facilities

COORDINATES IN NAD MICHIGAN STATE PLANE SOUTH (FEET)			
EASTING	NORTHING	TRANSECT	DISTANCE FROM SHORE
13454929.31	265102.45	11	0
13454937.89	265107.60	11	10
13454946.46	265112.74	11	20
13454955.04	265117.89	11	30
13454963.61	265123.03	11	40
13454972.19	265128.18	11	50
13454993.63	265141.04	11	75
13455015.06	265153.90	11	100
13455027.11	264922.76	12	0
13455036.36	264926.57	12	10
13455045.61	264930.37	12	20
13455054.85	264934.18	12	30
13455064.10	264937.99	12	40
13455073.35	264941.80	12	50
13455096.46	264951.31	12	75
13455119.58	264960.83	12	100
13455110.61	264735.70	13	0
13455119.67	264739.95	13	10
13455128.72	264744.20	13	20
13455137.77	264748.45	13	30
13455146.83	264752.69	13	40
13455155.88	264756.94	13	50
13455178.51	264767.56	13	75
13455201.14	264778.18	13	100
13455196.12	264549.55	14	0
13455205.36	264553.36	14	10
13455214.61	264557.17	14	20
13455223.86	264560.97	14	30
13455233.10	264564.78	14	40
13455242.35	264568.59	14	50
13455265.47	264578.11	14	75
13455288.59	264587.63	14	100
13455258.02	264356.74	15	0
13455267.97	264357.79	15	10
13455277.92	264358.84	15	20
13455287.86	264359.88	15	30
13455297.81	264360.93	15	40
13455307.75	264361.98	15	50
13455332.61	264364.59	15	75
13455357.48	264367.21	15	100

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COORDINATES IN NAD MICHIGAN STATE PLANE SOUTH (FEET)			
EASTING	NORTHING	TRANSECT	DISTANCE FROM SHORE
13455282.41	264153.35	16	0
13455292.28	264154.99	16	10
13455302.14	264156.64	16	20
13455312.01	264158.28	16	30
13455321.87	264159.93	16	40
13455331.73	264161.57	16	50
13455356.39	264165.68	16	75
13455381.05	264169.79	16	100
13455305.89	263949.85	17	0
13455315.83	263950.90	17	10
13455325.78	263951.95	17	20
13455335.72	263952.99	17	30
13455345.67	263954.04	17	40
13455355.61	263955.09	17	50
13455380.48	263957.70	17	75
13455405.34	263960.32	17	100
13455328.45	263746.25	18	0
13455338.39	263747.30	18	10
13455348.34	263748.34	18	20
13455358.28	263749.39	18	30
13455368.23	263750.44	18	40
13455378.17	263751.48	18	50
13455403.03	263754.10	18	75
13455427.90	263756.72	18	100
13455304.01	263542.91	19	0
13455313.87	263541.26	19	10
13455323.74	263539.62	19	20
13455333.60	263537.98	19	30
13455343.46	263536.33	19	40
13455353.33	263534.69	19	50
13455377.99	263530.58	19	75
13455402.65	263526.47	19	100
13455276.90	263339.86	20	0
13455286.84	263338.76	20	10
13455296.78	263337.65	20	20
13455306.72	263336.55	20	30
13455316.66	263335.44	20	40
13455326.60	263334.34	20	50
13455351.44	263331.58	20	75
13455376.29	263328.82	20	100

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Infrastructure, environment, facilities

COORDINATES IN NAD MICHIGAN STATE PLANE SOUTH (FEET)			
EASTING	NORTHING	TRANSECT	DISTANCE FROM SHORE
13455249.80	263136.81	21	0
13455259.66	263135.17	21	10
13455269.53	263133.52	21	20
13455279.39	263131.88	21	30
13455289.25	263130.24	21	40
13455299.12	263128.59	21	50
13455323.78	263124.48	21	75
13455348.44	263120.37	21	100
13455222.66	262933.77	22	0
13455232.60	262932.66	22	10
13455242.54	262931.56	22	20
13455252.48	262930.45	22	30
13455262.42	262929.35	22	40
13455272.35	262928.25	22	50
13455297.20	262925.49	22	75
13455322.05	262922.72	22	100
13455191.58	262731.52	23	0
13455201.45	262729.88	23	10
13455211.31	262728.24	23	20
13455221.17	262726.59	23	30
13455231.04	262724.95	23	40
13455240.90	262723.30	23	50
13455265.56	262719.19	23	75
13455290.22	262715.08	23	100
13455127.61	262536.92	24	0
13455137.10	262533.74	24	10
13455146.58	262530.56	24	20
13455156.06	262527.38	24	30
13455165.54	262524.21	24	40
13455175.02	262521.03	24	50
13455198.73	262513.08	24	75
13455222.43	262505.14	24	100
13455049.27	262362.77	25	0
13455058.91	262360.10	25	10
13455068.54	262357.43	25	20
13455078.18	262354.76	25	30
13455087.82	262352.09	25	40
13455097.45	262349.42	25	50
13455121.55	262342.75	25	75
13455145.64	262336.08	25	100

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COORDINATES IN NAD MICHIGAN STATE PLANE SOUTH (FEET)			
EASTING	NORTHING	TRANSECT	DISTANCE FROM SHORE
13454997.89	262164.47	26	0
13455007.53	262161.79	26	10
13455017.16	262159.12	26	20
13455026.80	262156.44	26	30
13455036.43	262153.76	26	40
13455046.07	262151.09	26	50
13455070.16	262144.40	26	75
13455094.24	262137.71	26	100
13454940.85	261968.02	27	0
13454950.09	261964.18	27	10
13454959.33	261960.35	27	20
13454968.56	261956.52	27	30
13454977.80	261952.69	27	40
13454987.04	261948.86	27	50
13455010.13	261939.28	27	75
13455033.22	261929.71	27	100
13454871.29	261775.56	28	0
13454880.92	261772.88	28	10
13454890.56	261770.20	28	20
13454900.19	261767.53	28	30
13454909.83	261764.85	28	40
13454919.46	261762.17	28	50
13454943.55	261755.48	28	75
13454967.64	261748.79	28	100
13454814.49	261578.74	29	0
13454823.97	261575.58	29	10
13454833.46	261572.42	29	20
13454842.95	261569.25	29	30
13454852.43	261566.09	29	40
13454861.92	261562.93	29	50
13454885.64	261555.02	29	75
13454909.35	261547.12	29	100

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Appendix C

Photo Log

ARCADIS

Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

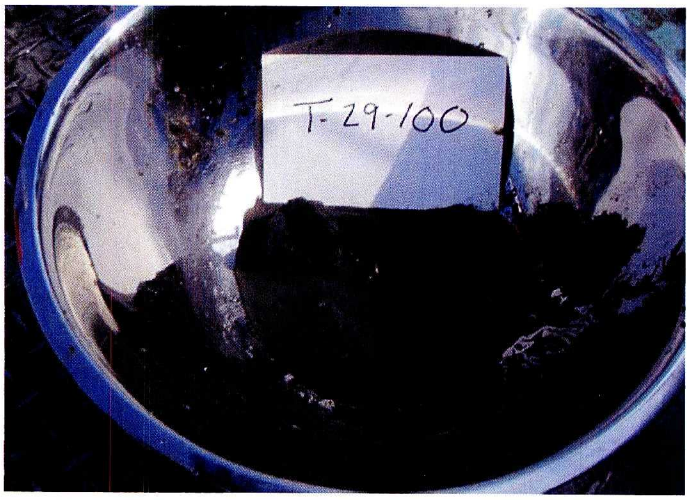

Photo No.: 1

Date: August 28, 2007

Direction: NA

Description:
Ponar sample collected at Transect 29-100. Sample consisted of medium grain sand, trace silt, and rock (rip rap).

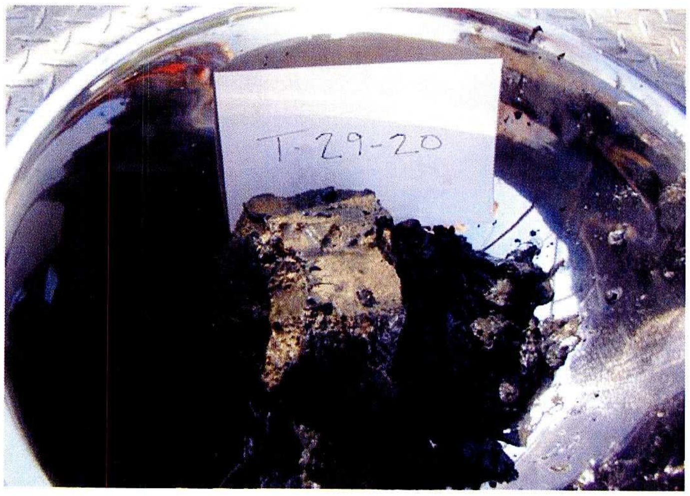

Photo No.: 2

Date: NA

Direction: August 28, 2007

Description:
Ponar sample collected at Transect 29-20. Sample consisted of gravel, medium to coarse sand, trace silt, and large rock (rip rap).

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

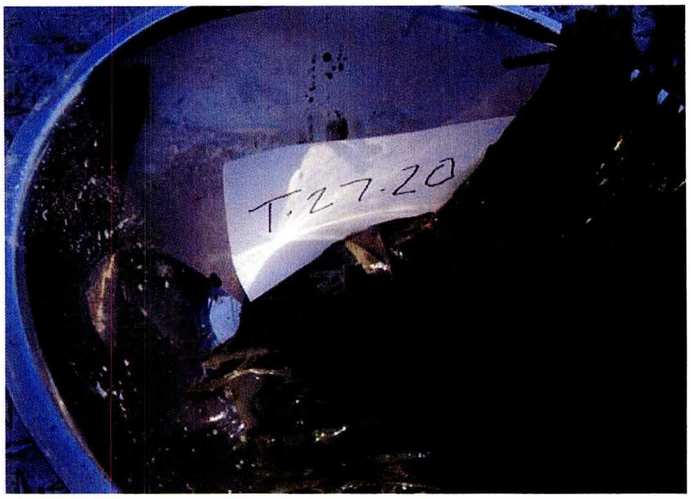

Photo No.: 3

Date: August 28, 2007

Direction: NA

Description:
Ponar sampled collected at Transect 27-20. Sample primarily consisted of aquatic vegetation with dark gray/brown silt, medium gravel, and trace fine to medium grained sand.

Photo No.: 4

Date: August 28, 2007

Direction: NA

Description:
Ponar sampled collected at Transect 28-30. Sample consisted of clayey silt, fine sand, trace medium gravel, and trace organic material.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

Photo No.: 5

Date: August 28, 2007

Direction: NA

Description:
Ponar sample collected at Transect 26-30. Sample consisted of dark gray sandy silt, and trace fine gravel.

Photo No.: 6

Date: August 28, 2007

Direction: NA

Description:
Ponar sample collected at Transect 26-100. Sample consisted of dark gray/brown silt and medium to coarse gravel.

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

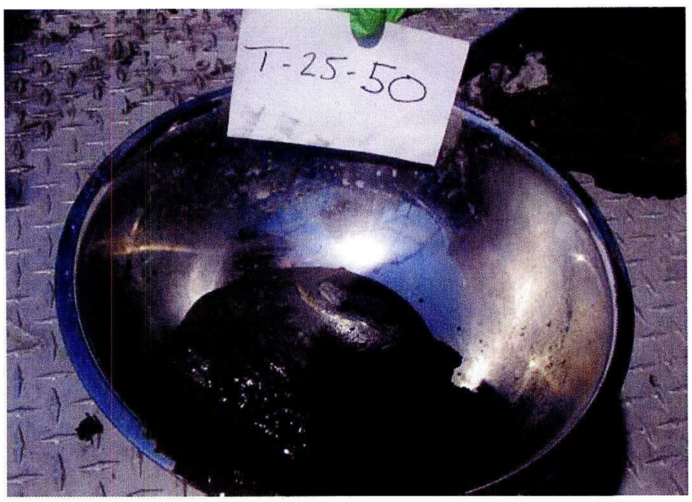

Photo No.: 7

Date: August 28, 2007

Direction: NA

Description:
Ponar sample collected at Transect 25-50. Sample consisted of gray/brown silt with trace fine sand.

Photo No.: 8

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 21-10. Sample consisted of dark gray silt, fine to medium grain sand, and trace fine gravel.

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 9

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 21-75. Sample consisted of fine to medium grain sand, fine to medium gravel, and trace organic material.

Photo No.: 10

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 19-30. Sample consisted of medium to coarse sand and trace gravel.

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 11

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 18-40. Sample consisted of gray/brown medium grain sand, trace silt, and trace fine gravel.

Photo No.: 12

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 1-75. Sample consisted of dark brown fine to medium grain sand, some silt, and trace fine to medium gravel.

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 13

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 3-20. After three attempts, a small amount of gravel and rock were recovered.

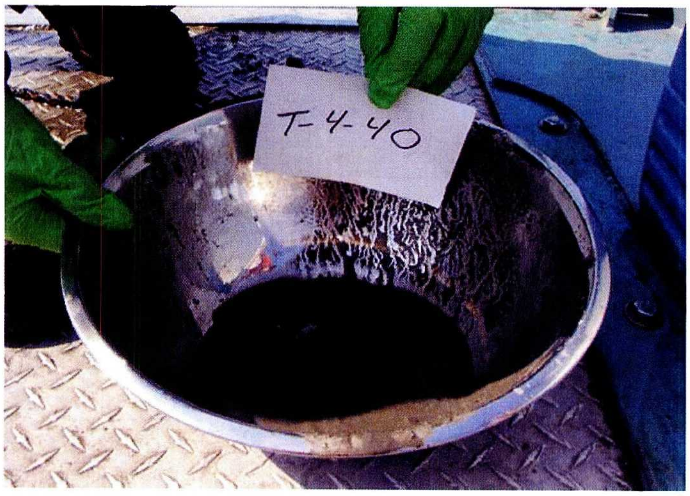

Photo No.: 14

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 4-40. Sample consisted of dark brown medium to coarse grain sand, medium to coarse gravel, and trace silt.

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 15

Date: August 29, 2007

Direction: NA

Description:
Ponar sample collected at Transect 5-30. Sample consisted of dark brown fine to medium grain sand, medium to coarse gravel, pieces of brick, and trace clay and silt.

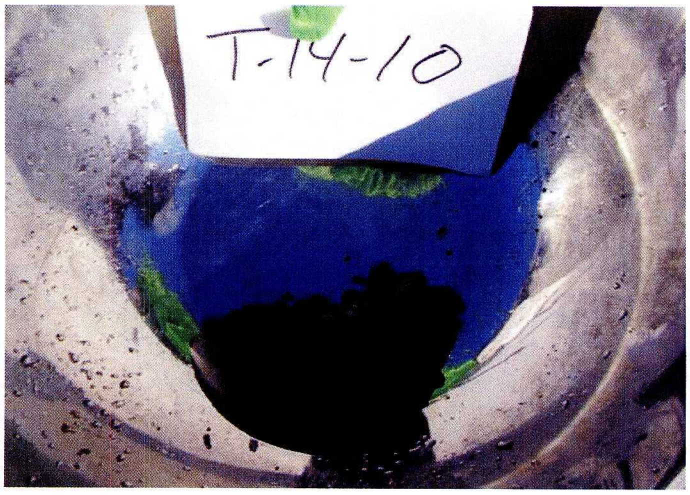

Photo No.: 16

Date: August 30, 2007

Direction: NA

Description:
Ponar sample collected at Transect 14-10. Sample consisted of rock and gravel with trace sand.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

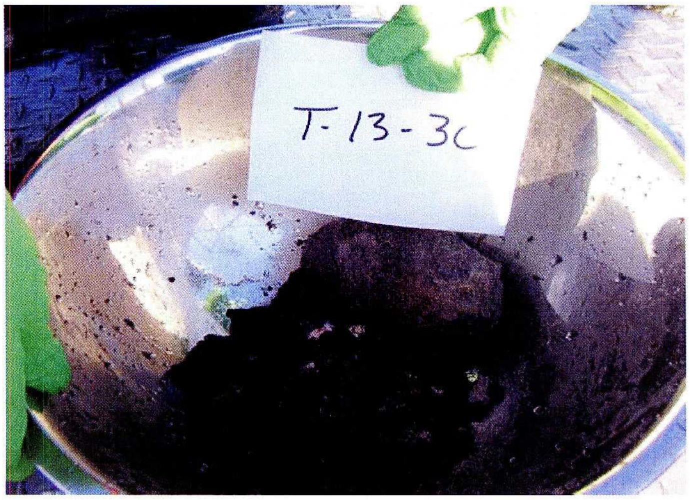

Photo No.: 17

Date: August 30, 2007

Direction: NA

Description:
Ponar sample collected at Transect 13-30. Sample consisted of brown medium to coarse grain sand, and medium to coarse gravel.

Photo No.: 18

Date: August 30, 2007

Direction: NA

Description:
Ponar sample collected at Transect 11-40. Sample consisted of brown medium to coarse grain sand, medium to coarse gravel, and trace silt.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

Photo No.: 19

Date: August 30, 2007

Direction: NA

Description:
Ponar sample collected at Transect 10-30. After three attempts, one rock and trace sand was recovered.

Photo No.: 20

Date: August 30, 2007

Direction: NA

Description:
Ponar sample collected at Transect 7-10. Sample consisted of medium to coarse gravel, pieces of brick, and trace gray clay.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

Photo No.: 21

Date: August 30, 2007

Direction: NA

Description:
Ponar sample collected at Transect 6-10. The third attempt consisted of medium to coarse gravel and trace sand.

Photo No.: 22

Date: August 31, 2007

Direction: North

Description:
View of the Army Corps of Engineers barge that prevented access to the proposed Vibracore sample at Transect 24-10.

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 23

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 25-50. View of the top of the core from 0 (top of photo) to 1.4 feet.

Photo No.: 24

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 25-50 from 0.5 feet (top of photo) to 2.2 feet.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

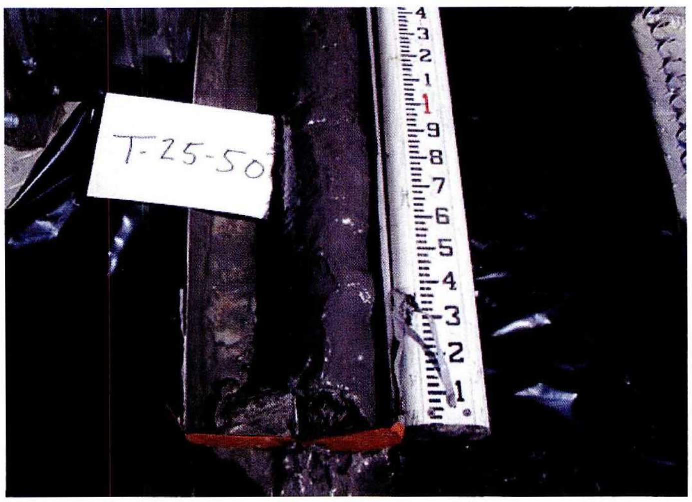

Photo No.: 25

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 25-50. View of the bottom of the core from 4.1 feet (top of photo) to 5.5 feet (bottom of photo).

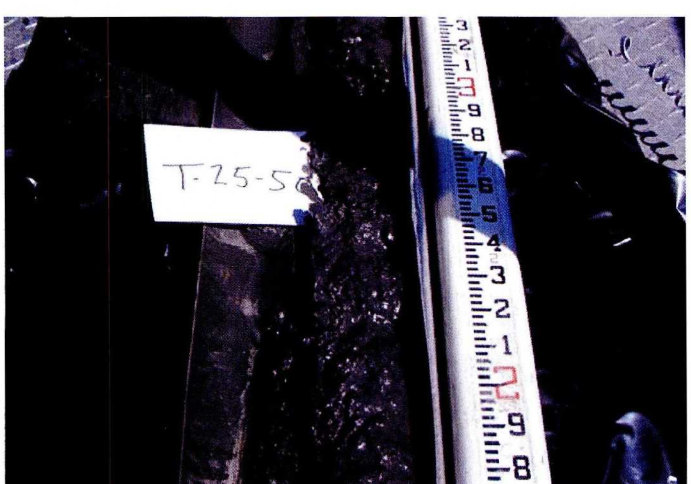

Photo No.: 26

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 25-50. View of the 2.2- to 3.8-foot interval from top to bottom.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

Photo No.: 27

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 29-75 from 0 feet (top of photo) to 1.1 feet.

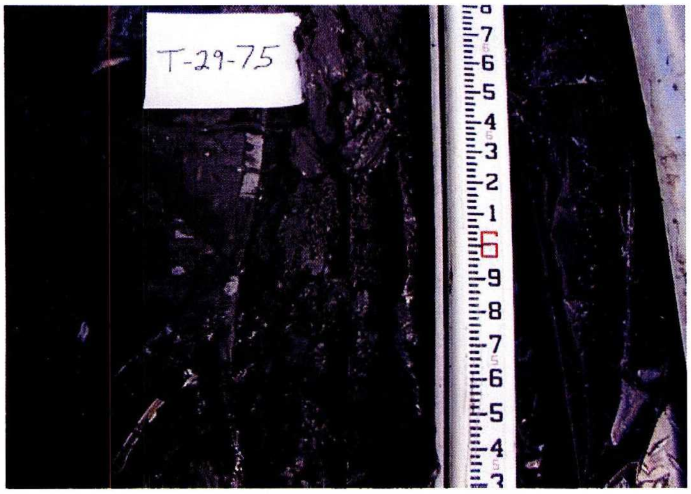

Photo No.: 28

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 29-75 from 1 foot (top of photo) to 2.5 feet (bottom of photo).

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

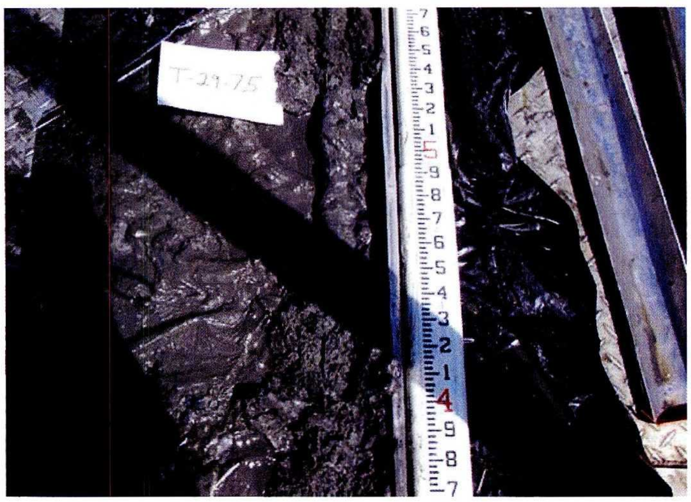

Photo No.: 29

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 29-75 from 2.1 feet (top of photo) to 4.1 feet (bottom of photo).

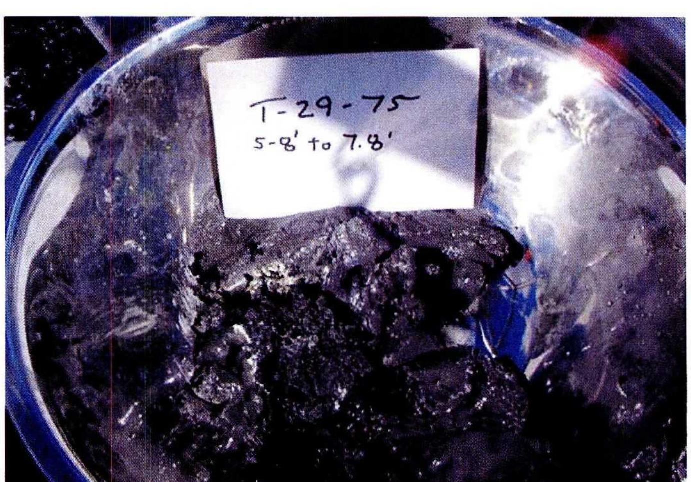

Photo No.: 30

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 29-75. View of the 5.8- to 7.8-foot interval.

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 31

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 29-75 from 4.4 feet (top of photo) to 6.1 feet (bottom of photo).

Photo No.: 32

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 29-75 from 6.2 feet (top of photo) to 7.8 feet (bottom of photo).

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

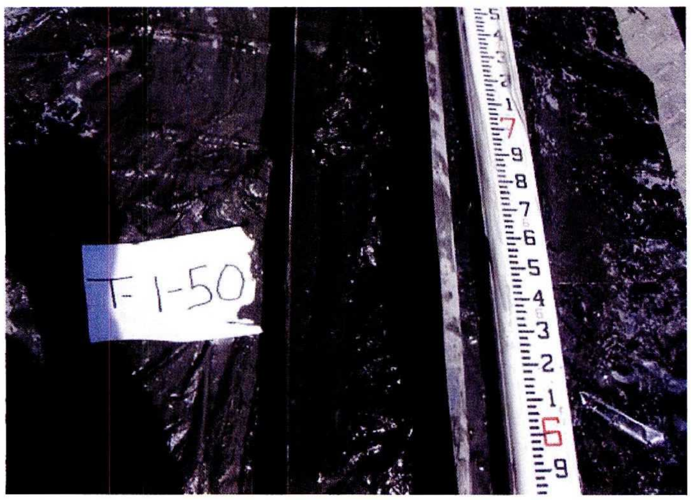

Photo No.: 33

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 1-50. View of the top of the core from 0 feet (top of photo) to 1.7 feet (bottom of photo).

Photo No.: 34

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 1-50 from 1.6 feet (top of photo) to 3.4 feet (bottom of photo).

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 35

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 1-50 from 2.5 feet (top of photo) to 4.4 feet (bottom of photo).

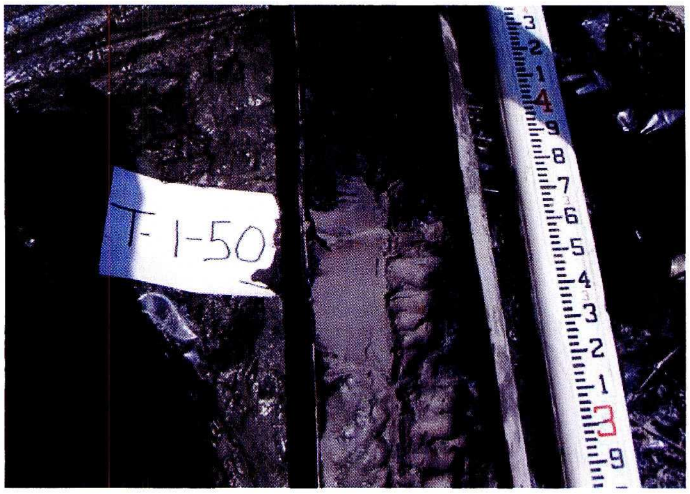

Photo No.: 36

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 1-50 from 3.1 feet (top of photo) to 4.7 feet (bottom of photo).

Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 37

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 1-50 from 4.9 feet (top of photo) to 6.5 (bottom of photo) feet.

Photo No.: 38

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 1-50. View of the bottom of the core from 5.5 feet (top of photo) to 7.5 feet.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

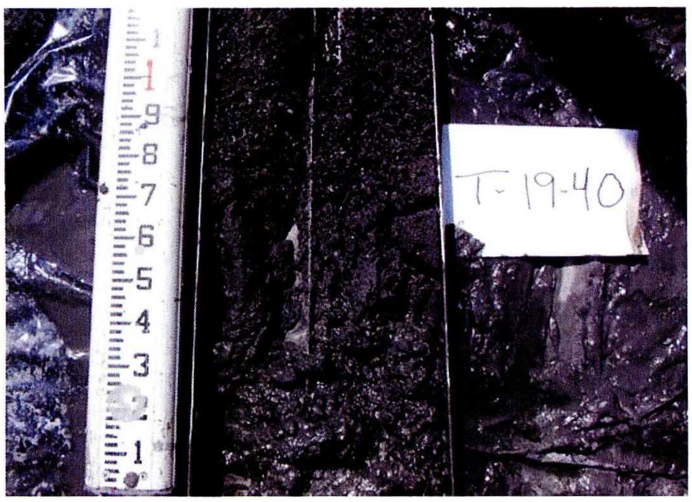

Photo No.: 39

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 19-40. View of the top of the core from 0 feet (bottom of photo) to 1.2 feet.

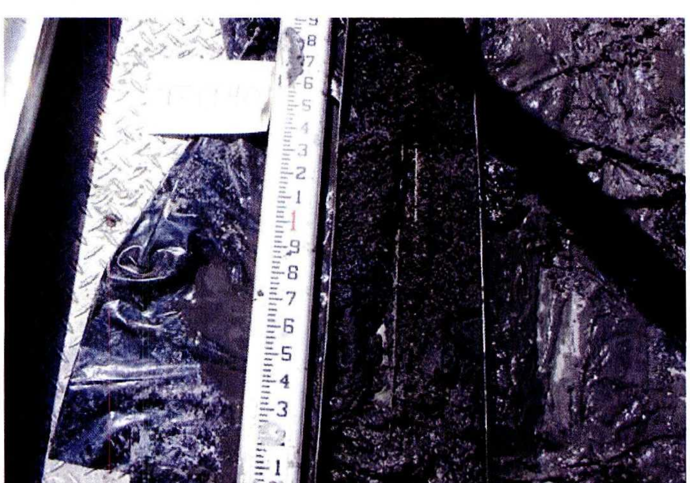

Photo No.: 40

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 19-40. View of the bottom of the top of the core from 0 feet (bottom of photo) to 1.9 feet.

Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 41

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 19-40 from 2.2 feet (bottom of photo) to 3.7 feet.

Photo No.: 42

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 19-40 from 2.6 feet (bottom of photo) to 3.7 feet.

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 43

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 19-40 from 3.8 feet (bottom of photo) to 5.4 feet.

Photo No.: 44

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 19-40. View of the bottom of the core from 5 feet (bottom of photo) to 6.6 feet.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

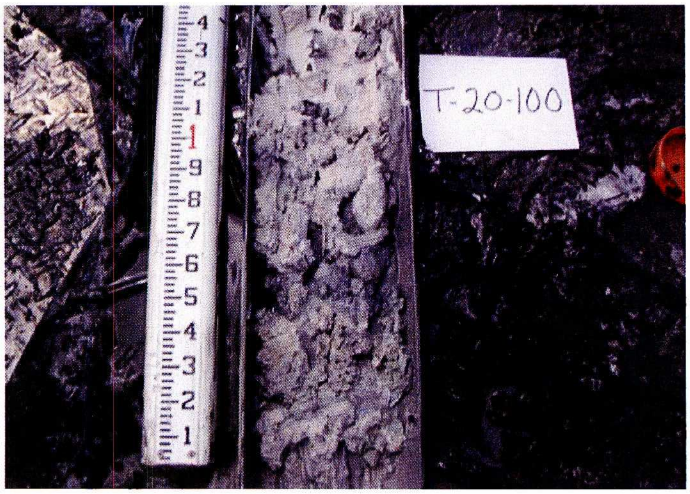

Photo No.: 45

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-100 from 0 feet (bottom of photo) to 1.5 feet.

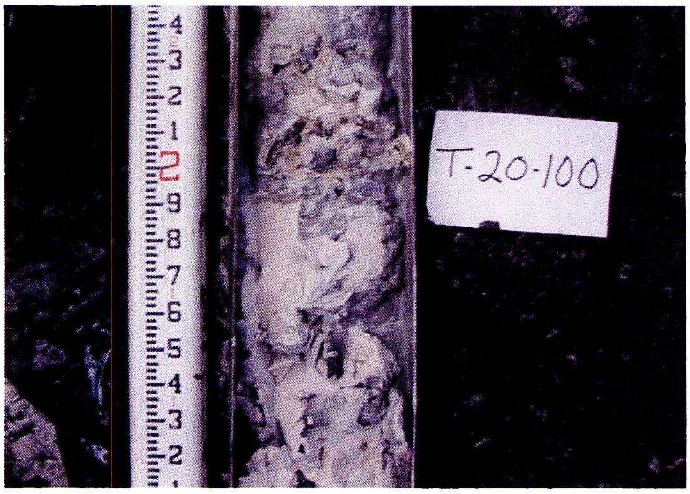

Photo No.: 46

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-100 from 1.1 feet (bottom of photo) to 2.5 feet.

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

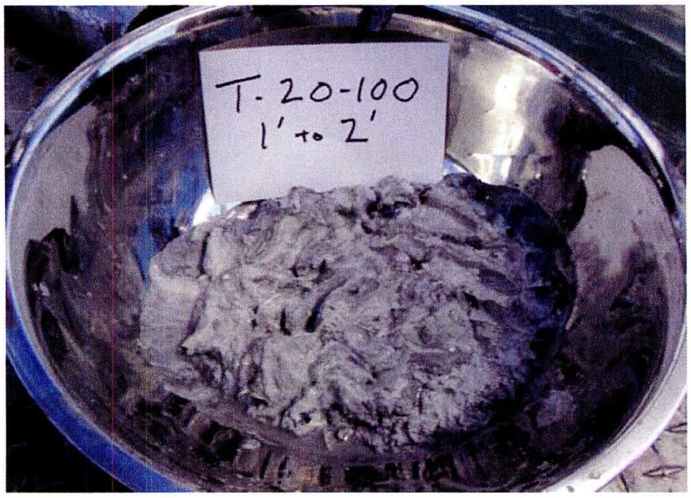

Photo No.: 47

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-100 from 1 to 2 feet.

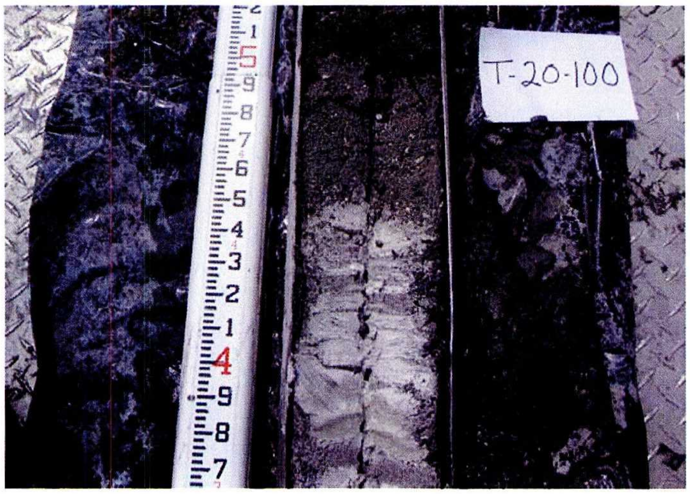

Photo No.: 48

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-100 from 3.7 feet (bottom of photo) to 5.2 feet (top of photo).

Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

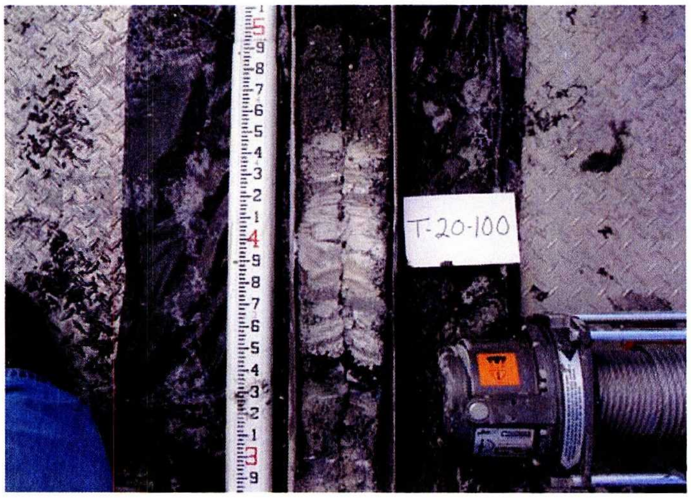

Photo No.: 49

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-100 from 2.8 feet (bottom of photo) to 5.1 feet.

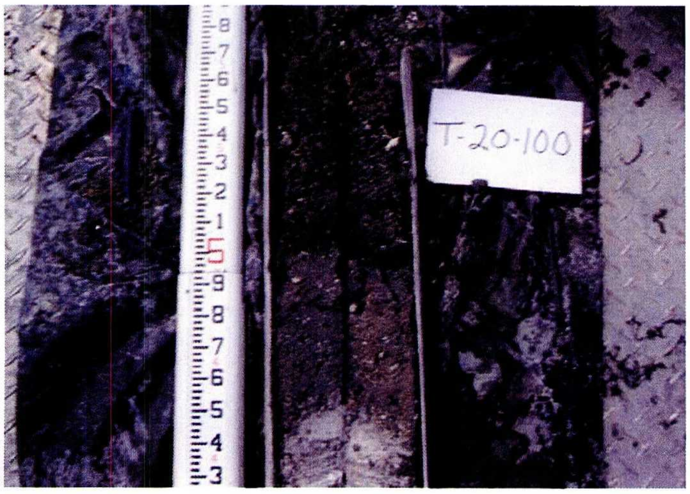

Photo No.: 50

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-100. View of the bottom of the core (top of photo) from 4.3 feet (at bottom of photo) to 5.7 feet.

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

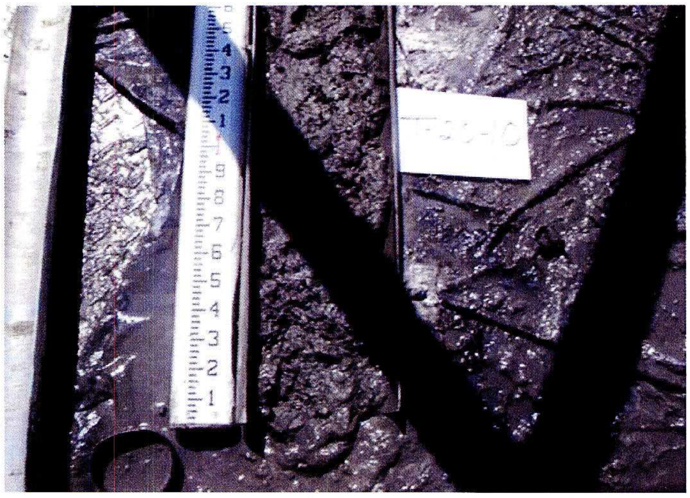

Photo No.: 51

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-10. View of the top of the core (bottom of photo) from 0 to 1.6 feet.

Photo No.: 52

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-10 from 1.5 feet (bottom of photo) to 2.7 feet.

ARCADIS
Infrastructure, environment, facilities

Project No.: B0042929.00010
Project Name: BASF-Sediment Study
City/State Wyandotte, MI

Photo No.: 53

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-10 from 1.3 feet (bottom of photo) to 2.9 feet.

Photo No.: 54

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-10 from 2.8 feet (bottom of photo) to 4.3 feet

ARCADIS
Infrastructure, environment, facilities

Project No.:	B0042929.00010
Project Name:	BASF-Sediment Study
City/State	Wyandotte, MI

Photo No.: 55

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-10 from 3.3 feet (bottom of photo) to 4.5 feet.

Photo No.: 56

Date: August 31, 2007

Direction: NA

Description:
Vibracore sample at Transect 20-10. View of the bottom of the core (top of photo) from 2.3 to 4.7 feet.

ARCADIS BBL

Appendix D

Field Logs

(1)

B0042929 BASF 8/27/07

WEATHER: 70s, P. CLOUDY
LEVEL D H&S
0725 ARCADIS ON SITE -
T. WHARTON, T. MATTISON, &
J. GUTKOWSKI - T.M. & J.G.
ATTEND BASF CONTRACTOR
TRAINING
T.W. MET W/ M. GERDENICH BASF
& JEAN MICHAEL - BASF ENGINEERING
313-363-3084 CELL #
REVIEWED SITE MAPS.
T.W., T.M., J.G & GERDENICH MET
@ 0810 - DISCUSSED & SIGNED
HOT/SAFE WORK PERMIT
HEALTH & SAFETY MEETING - J.G & T.M.
SIGNED ARCADIS HASP

ABANDONED WASTE PIPE FROM
BASF DOCK TO FIGHTING ISLAND
- PIPE HAS BEEN CAPPED BUT
IS STILL IN PLACE
- T.M. & J.G. SET UP SURVEY
CONTROL POINTS
T.W & M. GERDENICH INSPECT
SHORELINE FOR UTILITIES

NO MARKED utilities
LOCATED BASF OUTFALLS &
INTAKE - SHOULD NOT INTERFERE
W/ SEDIMENT STUDY
1105 CALLED M. ERICKSON & L. TOMLINSON
(ARBL) W/ UPDATES
1128 CALLED ART OSTASZEWSKI (CLOER)
LEFT VOICE MAIL
1205 T.W. OFF SITE TO PICK UP
FED EX PACKAGE - 1300 BACK TO
SITE. T.M. & J.G. STILL SURVEYING
CONTROL POINTS
NOTE: DAILY HOT/SAFE WORK
PERMITS EXPIRE @ 1730

- TAILGATE MEETING FORM COMPLETED
& WILL BE DONE DAILY
1420 CALLED GERDENICH W/
UPDATES
T.W. MOVED TO PIER 500
MARINA - ARCADIS B&L
BOAT LOCATION & ASSEMBLED
PIPE FOR SEDIMENT PROBING
M.T. & J.G. CONTINUED
SURVEY WORK

1625 - HANDED IN
HOT/SAFE WORK PERMIT
TO GERDENICH - HAD
BRIEF MEETING ALSO VIA
PHONE W/ GERDENICH &
ERICKSON
SURVEY CONTROL POINTS
ARE ESTABLISHED - WILL
BEGIN SEDIMENT PROBING
TOMORROW MORNING
1645 OFF SITE

B0[illegible]2929 BASF 8/28/07

WEATHER: 70s, P. CLOUDY
LEVEL D H&S
TASK: SEDIMENT STUDY OFF
SHORE OF NORTH WORKS
0723 T. WHARTON ON SITE
T. MATTISON & S. GUTROWSKI
ON SITE - SET UP AT CONTROL
POINT - SOUTH BASF PARKING LOT
0730 MET w/ M. GERDENICH - HOT/
SAFE WORK PERMIT REVIEW - GOOD
UNTIL 1730. WATCH FOR OUTFALLS -
ABAND DBO LINE IN RIVER
T.W. CONDUCTS TAILGATE MEETING
- SEE COMPLETED FORM
NOTE - ART OSTASZEWSKI (DEQ) CALLED
TW LAST NIGHT - GAVE PERMISSION
TO DISCARD EXCESS SEDIMENT
SAMPLES BACK IN RIVER -
TW NOTIFIED M. GERDENICH @ 0728
0810 GPS CONTROL FUSE BLEW
J.G. PURCHASED NEW
ALL BAGGED IN w/ GUARD
0920 LEFT DOCK

B0042929 BASF 8/28/07

0938 ARRIVE @ TRANSECT 29
(SOUTH END)
SAMPLE IDs w/ BE
T-29-10, T-29-20, T-29-30, ETC
-10, -20 - ETC 15 FEET FROM
SHORE
ART & RICH (DEQ) & GERDENICH
WATCH FROM SHORE
T-29-10 - 3.5 H_2O DEPTH
USE 3/4" METAL PROBE
ROCK & GRAVEL FEEL
NO SOFT SEDIMENTS/PROBE DEPTH ·0

T-29-20 0957 EXTEND PROBE
H_2O DEPTH - 8.8'
4.5' PROBE DEPTH (INTO SEDIMENT)
SAND SILT OVER ROCK FEEL
PHOTO ~1
PONAR SAMPLE
LARGE ROCK (RIP WRAP), GRAVEL,
SOME SOFT SILT
DARK GRAY/BROWN - MED. TO
COURSE SANDS - NO ODOR/SHEEN

6

B0042929 BASF 8/28/07

T-29-30 1028
H_2O DEPTH = 9.4'
PROBE DEPTH = 5.8'
SAME DESCRIPTION AS T29-20

T29-40 1030
H_2O DEPTH = 11.1
PROBE DEPTH: 4.3'
STIFF BOTTOM @ 4.3' POSSIBLY CLAY
UPPER PORTION SAME AS PREVIOUS

T-29-50 1034
H_2O DEPTH = 12.1
PROBE - 3' - STIFF BOTTOM/CLAY
@ 3' - SAME UPPER DESC AS
PREVIOUS

T-29-75 1038
H_2O DEPTH: 16.0'
PROBE DEPTH = 12'
SAND SILT ON TOP OF ROCK/GRAVEL
FEEL

7

B0042929 BASF 8/28/07

T-29-100 - 1045
H_2O DEPTH - 21.0
PROBE DEPTH: 3.3
STIFF MATERIAL @ BOTTOM
+ PONAR
PHOTO #2
LITTLE RECOVERY - MED. GRAIN
BR. SAND, TRACE SILT, ROCKS: 1-3" DI

T-28-10 1057
H_2O DEPTH = 5.9'
PROBE DEPTH = 1/10'
ALL ROCK - VISIBLE FROM
BOAT

T-28-20 1100
H_2O DEPTH = 11.1
PROBE DEPTH = 8.9'
SAND / SILT OVER CLAY
TOO ROUGH (WATER/BOAT
TRAFFIC) TO GRAB PONAR

(8)

B0042929 BASF 8/28/07

T-28-30 1108
H2O DEPTH ~13.2'
PROBE DEPTH: 6.8'
PONAR SAMPLE / PHOTO #3
CLAYEY SILT, DARK GRAY, SOME FINE SAND, TRACE MED. GRAVEL, TRACE ORGANIC MATERIAL

T28-40 1114
H2O DEPTH: 15.8'
PROBE DEPTH = 6.7'
SAND/SILT OVER STIFF CLAY
SIMILAR TO -30
DEQ ON SITE W/ BOAT (CHRIS & RICH)

T-28-50 1120
H2O DEPTH = 17.2'
PROBE DEPTH: 7.2
SAME DESCRIPTION AS PREV.
HARD BOTTOM (SAA) FEEL

T-28-75 1126
H2O DEPTH = 19.6'
PROBE DEPTH = 8.7'
SAA

(9)

B0042929 BASF 8/28/07

T-28-100 1134
H2O DEPTH = 21.2
PROBE DEPTH: 7.7'
SAA - HARD BOTTOM ~ POSSIBLY CLAY FEEL

T-27-10 1152
H2O DEPTH = 3.2'
PROBE DEPTH = <1"
ROCK/GRAVEL
DEQ OFF SITE

T-27-20 1201
H2O DEPTH = 8.9'
PROBE DEPTH = 12.1' SAA
PONAR PHOTO #4
~ SEAWEED W/ SOME DARK GRAY/BROWN SILT, MED. GRAVEL TRACE BR. FINE/MED. GRAIN SAND

T-27-30 1208
H2O DEPTH: 11.9'
PROBE DEPTH = 9.1
SAA

B0042929 BASF 8/28/07

T-27-40 1214
H2O DEPTH 13.9'
PROBE DEPTH ~ 11'
SAA

T-27-50 1218
~~T-27~~ H2O DEPTH = 15.5'
PROBE DEPTH = ~~15.5~~ → 6.5'
SAA

T-27-75 1227
H2O DEPTH 19.0'
PROBE DEPTH = 6.2'
SAA

T-27-100
H2O DEPTH = 20.1'
PROBE DEPTH = 4.7'
SAA

T-26-10 1240
H2O DEPTH - 3.8'
PROBE DEPTH 0-
ROCK / GRAVEL FEEL
BEQ ON SITE W/ BOAT - ART
& RICH

B0042929 BASF 8/28/07

T-26-20 1244
H2O DEPTH = 10.2'
PROBE DEPTH: 1.4'
HARD BOTTOM, SAND SILT ABOVE
- FEW LEAVES

T-26-30 1252
H2O DEPTH: 11.5
PROBE DEPTH = ~~16.2~~ 15.7'
PONAR & PHOTO #5
- DARK GRAY, SANDY SILT
TRACE FINE GRAVEL,
- TRACE ORGANIC ODOR

T-26-40 1259
WATER DEPTH = 16.9'
PROBE DEPTH = 10.5'
SAA, SILT/SAND FEEL, HARD BOTTOM

T-26-50 1305
WATER DEPTH = 18.2
PROBE DEPTH = 9.5
SILTY FEEL OVER CLAY (SAA)

(12)

B[illegible]Y2929 BASF 8/28/07

T-26-75 1314

WATER DEPTH = 20.0

PROBE DEPTH = 10.0

SILT OVER SILTY CLAY OVER

STIFF CLAY FEEL

T-26-100 1326

WATER DEPTH = 21.0

PROBE DEPTH = 10.0

+ PONAR PHOTO 6

→ DARK GRAY/BROWN

LOOSE SILT, MED TO COARSE

SAND & GRAVEL, SOME

ORGANIC ODOR

← BOTTOM FELT LIKE STIFF CLAY

T-25-10 NEAR OUTFALL/WOOD POSTS

SKIP LOCATION -

T-25-20 1340

WATER DEPTH = 12.2

PROBE DEPTH = 13.3

GRAVEL OVER SILT/SAND OVER

SILTY CLAY OVER STIFF CLAY

(13)

BODY2929 BASF 8/28/07

T-25-30 1348

WATER DEPTH = 14.9

PROBE DEPTH : 13.7

SAME DESC. (SAA)

T-25-40 1401

WATER DEPTH = 16.0

PROBE DEPTH = 12.3

SAND SILT OVER SILTY CLAY

OVER STIFF BOTTOM

T-25-50 1410

WATER DEPTH = 17.0'

PROBE DEPTH : 9.1

SANDY SILT OVER FIRM BOTTOM

+ PONAR PHOTO #7

LT GRAY/BROWN SILT w/

TRACE FINE SAND, SLIGHT

SHEEN, ORGANIC ODOR OBSERVED

T-25-75 1426

WATER DEPTH ~ 21.9

PROBE DEPTH ~ 8.1

SAND/SILT OVER SILTY CLAY

OVER STIFF CLAY FEEL

B0042929 (14) BMSF 8/28/07

T-25-100
WATER DEPTH - 26.5'
PROBE DEPTH = 4.9'
MOSTLY SAND, SOME SILT FEEL
OVER STIFF BOTTOM

T-24-10 1441
WATER DEPTH: 14.2
PROBE DEPTH = 11.6
GRAVEL / SANDY SILT OVER
STIFF BOTTOM
+PONAR - ~~[illegible]~~
- NO SAMPLE - PONAR
IS DAMAGED

T-24-20 1448
WATER DEPTH - 17.3'
PROBE DEPTH = 11.3
SAND / SILT OVER STIFF
CLAY FEEL

B0042929 (15) BMSF 8/28/07

T-24-30 1507
WATER DEPTH: 18.0
PROBE DEPTH : ~~15.5~~ 10.5
DESC SAME AS PREVIOUS

T-24-40 1520
WATER DEPTH = 19.8
PROBE DEPTH = 8.9
DESC - SMA

→ NOTE REVIEWED TAILGATE
SAFETY MTG & CALLED PM - BMSF
GOLDORIZED to WORK OBO LINE

T-24-50 1531
WATER DEPTH : 25.0
PROBE DEPTH = 4.2'
DESC - SMA

T-24-75 1539
WATER DEPTH = 22.3
PROBE DEPTH = 5.3
SILT CLAY OVER SILT OVER
STIFF CLAY FEEL

(16)

00042929 8/28/07

T-23-100 1546

WATER DEPTH = 26.3

PROBE DEPTH = 5.2

SAND FEEL OVER STIFF BOTTOM

T-23-10 1556

WATER DEPTH = 19.0

PROBE-DEPTH = 0.8

SAND/SILT FEEL OVER HARD BOTTOM - WOOD/ROCK?

T-23-20 1602

WATER DEPTH = 19.9

PROBE DEPTH = 0.8

DESC = SAA

T-23-30 1606

WATER DEPTH = 21.0

PROBE DEPTH = 3.8

SAND/SILT FEEL THEN HARD BOTTOM

(17)

30042929 OHSF 8/28/07

T-23-40 1604

WATER DEPTH = 23.4

PROBE DEPTH = 1.0

SAND/SILT - HARD BOTTOM

T-23-56 1614

WATER DEPTH = 24.0

PROBE DEPTH = 3.8

DESC - SAA

T-23-75 1622

WATER DEPTH = 24.7

PROBE DEPTH = 4.3

DESC SAA w/ STIFF BOTTOM

T-23-100 1630

WATER DEPTH = 25.0

PROBE DEPTH = 5.0

SILT (DEBRIS (WOOD?)) OVER STIFF BOTTOM

DONE FOR DAY

1700 RETURN to DOCK

DE-PREP

- TRANSECTS 29, 28, 27, 26, 25, 24, & 23 COMPLETED
NO T-25-10 - OBSTRUCTIONS
SO 49 TOTAL LOCATIONS

1725 HANDED IN WORK PERMIT TO OPERATIONS
DISCUSSED DAYS ACTIVITIES
1755 OFF SITE

WEATHER: HIGH 70s P. CLOUDY
LEVEL D H&S
TASK: SEDIMENT STUDY OFF SHORE OF NORTH WORKS
0720 T. WITHAM ON SITE
TIM MATTISON & JASON GUTKOWSKI ALREADY ON SITE - CONTROL (GPS) IS SET UP
MET W/ JEAN MICHAEL (BASF)
OBTAINED HOT/SAFE WORK PERMIT
BADGED IN & MOVED TO BOAT
- T.W. CONDUCTED HEALTH & SAFETY / TAILGATE MEETING
- SEE FORM
0820 LEAVE DOCK
0841 ARRIVE AT T-22
T-22-10 0846
WATER DEPTH - 13.1
PROBE DEPTH - ∅
ROCKS / GRAVEL

T-22-20 0851
WATER DEPTH: 15.9
PROBE DEPTH: 1.9
SAND/SILT OVER HARD BOTTOM FEEL

B0042929 BASF 8/29/07

T-22-30 0854
WATER DEPTH = 17.6
PROBE DEPTH = 1.5
SAND / HARD BOTTOM FEEL

T-22-40 0858
WATER DEPTH = 18.1
PROBE DEPTH = 2.7
(SAA - DESCRIPTION)

T-22-50 0903
WATER DEPTH 20.6
PROBE DEPTH = 2.7
SAA (DESC)

T-22-75 0910
WATER DEPTH = 22.9
PROBE DEPTH = 1.2
DESC = SAA

T-22-100 0917
WATER DEPTH = 24.5
PROBE DEPTH = 1
GRAVEL / SAND / HARD BOTTOM FEEL

B0042929 BASF 8/29/07

T-21-10 0926
WATER DEPTH = 14.9
PROBE DEPTH = 13.1
SANDY SILT FEEL - HARD BOTTOM

T-21-20 0930
WATER DEPTH = 18.0
PROBE DEPTH = 6.5
DESC = SAA
PHOTO #8
T-21-10 PONAR
DARK GRAY SILT / FINE & MED SANDS, TRACE FINE GRAVEL / SHEEN & ORGANIC ODOR

T-21-30 0934
WATER DEPTH = 20.0
PROBE DEPTH = 11
SANDY SILT OVER HARD BOTTOM FEEL

T-21-40 0941
WATER DEPTH = 22.2'
PROBE DEPTH = 9.3'
DESC = SAA

(22)

B0042929 BASF 8/29/07

T-21-50 0947
WATER DEPTH = 23.5
PROBE DEPTH = 7.6
DESC - SAA

T-21-75 0953
WATER DEPTH = 26.0
PROBE DEPTH = 6.1
PONAR PHOTO-9
FINE & MED SAND, SOME SILT,
FINE & MED GRAVEL, TRACE
ORGANICS, SHEEN, ORGANIC
ODOR

T-21-100 1000
WATER DEPTH : 27.9
PROBE DEPTH : 6.1
SILTY SAND OVER HARD BOTTOM FEEL

T-20-10 1007
WATER DEPTH = 18.2
PROBE DEPTH = 10.6
SILTY SAND OVER SANDY SILT
OVER HARD BOTTOM FEEL

(23)

B0042929 BASF 8/29/07

T-20-20 1014
WATER DEPTH = 21.0
PROBE DEPTH : 7.5
SANDY SILT OVER SAND OVER
HARD BOTTOM FEEL

T-20-30 1020
WATER DEPTH = 22.7
PROBE DEPTH = ~~22~~ 7.1 29.8
SANDY SILT OVER SAND w/
HARD BOTTOM

T-20-40 1027
WATER DEPTH : 24.0
PROBE DEPTH : 6.2 30.2
SAA = DESC.

T-20-50
WATER DEPTH = 24.7 1035
PROBE DEPTH = 6.1
SILTY SAND OVER HARD BOTTOM FEEL

T-20-75 1042
WATER DEPTH = 27.1
PROBE DEPTH = 3.6
SAA (DESC)

(24)

80042929 ~~000~~ BASF 8/29/07

T-20.100 1053

WATER DEPTH = 28.3

PROBE DEPTH : 5.4 33.7

DESC = SAA

T-19-10 1100

WATER DEPTH = 16.1

PROBE DEPTH = 11.2 27.3

SAND FEEL OVER HARD BOTTOM

T-19-20 1109

WATER DEPTH : 20.8

PROBE DEPTH : 5.2 26.0

DESC := SAA

T-19.30 1119

WATER DEPTH : 23.1

PROBE DEPTH : 6.2 29.3

DESC : SAA

+ PONAR ~~PHOTO # 10~~

→ DARK GRAY - MED. to

COARSE SAND, TRACE GRAVEL

TRACE SHEEN & ORGANIC ODOR

(25)

80042929 BASF 8/29/07

T-19.40 1127

WATER DEPTH : 25.6

PROBE DEPTH : 4.3

DESC : SAA ~~PHOTO 10~~ TW

~~+ PONAR~~

T-19.50 1135

WATER DEPTH : 26.8

PROBE DEPTH : 3.2

SANDY SILT OVER SANDY GRAVEL

OVER HARD BOTTOM FEEL

T-19-75 1142

WATER DEPTH : 29

PROBE DEPTH : 2.7

SAND / GRAVEL OVER HARD BOTTOM

T-19-100 1149

WATER DEPTH : ~~31. 29.0~~ TW 31.0

PROBE DEPTH - ~~31. 2.7~~ 4.0

SAND / GRAVEL FEEL OVER HARD BOTTOM

SIMILAR to 19.75

1210 REVIEW TAILGATE MEETING

SAFETY DISCUSSION

26

B0042929 BHSF 8/29/07

T-18-10 1225

WATER DEPTH - 18.0

PROBE DEPTH - 0.9

SAND OVER TIGHT SAND

T-18-20 1236

WATER DEPTH - 21.9

PROBE DEPTH - 0.2

SAND OVER HARD BOTTOM

T-18-30 1242

WATER DEPTH: 24.5

PROBE DEPTH: 1.5

TIGHT SAND FEEL

T-18-40 - 1249

WATER DEPTH = 25.0

PROBE DEPTH = 3.9

SANDY FEEL OVER TIGHT SAND

- PONAR PHOTO # 11

GRAY BROWN MED SAND / TRACE SILT / TRACE FINE GRAVEL & TRACE SHEEN / ORGANIC ODOR

27

B0042929 BHSF 8/29/07

T-18-50 1255

WATER DEPTH = 26.1

PROBE DEPTH = 3.4

SAND / SILT OVER HARD BOTTOM

T-18-75 1307

WATER DEPTH = 29.0

PROBE DEPTH = 2.3

SAND FEEL OVER HARD BOTTOM

T-18-100 1317

WATER DEPTH = 31.5

PROBE DEPTH = 2.5

SAND SILT FEEL OVER ROCKS

MOBE TO NORTH END

T-1-10 1530

WATER DEPTH = 4.1

PROBE DEPTH = 0

- ROCKS

T-1-20 1536

WATER DEPTH = 4.1

PROBE DEPTH = 0

SAA

(28)

B0042929 BASF 8/29/07

T-1-30 1345

WATER DEPTH: ~~12.5~~ 11.3

PROBE DEPTH: 0.5

GRAVEL OVER ROCK

T-1-40 1348

WATER DEPTH = 13.2

PROBE DEPTH = 0.8

SAA

T-1-50 1352

WATER DEPTH = 15.9

PROBE DEPTH = 6.9 23.8

SILTY SAND FEEL OVER HARD BOTTOM

T-1-75 1400

WATER DEPTH 22.0

PROBE DEPTH = 2.6

SILTY CLAY FEEL OVER STIFF CLAYEY BOTTOM

PONAR PHOTO # 12

DARK GR. FINE MED SAND, SOME SILT, FINE TO MED GRAVEL (TRACE)

(29)

B0042929 BASF 8/29/07

T-1-100 1410

WATER DEPTH: 24.0

PROBE DEPTH: 1.5

SAME AS PONAR OVER STIFF CLAY LIKE FEEL

T-2-10 1413

WATER DEPTH = 17.0

PROBE DEPTH = 3.0

SAND (SAA) OVER STIFF CLAY FEEL

T-2-20 1416

WATER DEPTH 18.4

PROBE DEPTH = 2.8

SAA (DESC)

T-2-30 1420

WATER DEPTH: ~~21.5~~ 21.2

PROBE DEPTH: 3.6

SAA

T-2-40 1423

WATER DEPTH 22.0

PROBE DEPTH 1.0

SAA

(30)

B0042929 BASF 8/29/07

T-2-50 1429
WATER DEPTH 22.0
PROBE DEPTH = 3.0
DESC = SAA

T-2-75
WATER DEPTH = 25.0
PROBE DEPTH 1.2
SAA

T-2-100 1438
WATER DEPTH 27.1
PROBE DEPTH 1.6
SAA

T-3-10 1449
WATER DEPTH = 19.0
PROBE DEPTH = 0.3
SAND/GRAVEL FEEL

T-3-20 1458
WATER DEPTH = 20.0
PROBE DEPTH = 2.9
SAND OVER CLAY FEEL
~ PONAR PHOTO # 13
2 ATTEMPTS - ONLY GRAVEL & ROCK RECOVERED

(31)

B0042929 BASF 8/29/07

T-3-30 1506
WATER DEPTH = 22.1
PROBE DEPTH = 1.8
SMALL AMOUNT OF SAND OVER STIFF CLAY FEEL

T-3-40 1510
WATER DEPTH = 22.9
PROBE DEPTH = 1.4
SOME SAND OVER STIFF CLAY FEEL

T-3-50 1512
WATER DEPTH = 23.9
PROBE DEPTH = 0.8
SAA - DESC
CALLED PM ERICKSON - PONAR REVEALED NO SILT/SEDIMENT
PROBING FELT SIMILAR AT SUBSEQUENT LOCATIONS -
THEREFORE: NO 75 & 100 LOCATIONS

B0042929 BASF 8/29/07

T-4-10 1523
WATER DEPTH = 19.8
PROBE DEPTH = 0.5
SAND/GRAVEL FLAT w/
HARD BOTTOM

T-4-20 1529
WATER DEPTH : 22.4
PROBE DEPTH : 0.2
SAA

T-4-30 1536
WATER DEPTH = 23.9
PROBE DEPTH = ~~2~~ 1.0
SAA

T-4-40 1545
WATER DEPTH = 24.0
PROBE DEPTH : ~~25.0~~ 1.0
→ PONAR PHOTO # 14
2 ATTEMPTS
DARK BR / MED-COARSE
SAND, TRACE SILT, MED to
COARSE GRAVEL, SHEEN
MILD ORGANIC ODOR

B0042929 BASF 8/29/07

~~T-4-50~~ T-4-50 1553
WATER DEPTH : 25.1
PROBE DEPTH : ~~26.1~~ 1.0
SAME AS PONAR - T-4-40
DESCRIPTION

T-5-10 1601
WATER DEPTH : 20.9
PROBE DEPTH : Ø
GRAVEL / COBBLES

T-5-20 1604
WATER DEPTH : 22.9
PROBE DEPTH : 1.1
SAND / GRAVEL OVER STIFF CLAY

T-5-30 1606
WATER DEPTH = 24.9
PROBE DEPTH = ~~25.4~~ 0.5
SAA
= PONAR PHOTO # 15
DARK BR FINE-MED SAND/
MED - COARSE GRAVEL, COBBLES,
BRICKS / TRACE CLAY / TRACE SILT

34

B0042929 BASF 8/29/07

T.5.40 1609

WATER DEPTH: 25.2

PROBE DEPTH: ~~[illegible]~~ 0.8

- SAA

T-5-56 1623

WATER DEPTH 26.0

PROBE DEPTH 0.5

- SAA

1643 RETURN TO DOCK & DE-PREP

1656 BADGE OUT of BASF

MET w/ M. ERICKSON &

M. GERDEWICH - HANDED

IN WORK PERMIT TO M.G. -

- DISCUSSED WORK

COMPLETED & S.O.W -

1737 OFF SITE

[signature]

35

B0042929 BASF 8/30/07

WEATHER: HIGH 60s, M. CLOUDY

LEVEL D HES

TASK: SEDIMENT STUDY OFF

SHORE OF NORTH WORKS

0728 T. WHARTON ON SITE

T. MATTISON & J. GUTKOWSKI

ON SITE - CONTROL IS ALREADY

SET UP -

OBTAINED SAFE / HOT WORK

PERMIT FROM JOHN MICHAEL

(BASF) BADGE IN & MOBE

TO BOAT

- TW CONDUCTED HEALTH &

SAFETY TAILGATE MEETING

- SEE FORM

NOTE STRONG NORTH WIND -

DIFFICULT TO POSITION BOAT

T-15-10 0815

WATER DEPTH = 15.7

PROBE DEPTH = 0.1

SANDY GRAVEL / HARD BOTTOM FEEL

T.15-20 0818

WATER DEPTH = 18.2

PROBE DEPTH = 0.2

SAND / GRAVEL

(36)

B0042929 BHSF 8/30/07

T-15-30 0824

WATER DEPTH = 20.5

PROBE DEPTH = 0.5

SAA (DESC)

T-15-40 0830

WATER DEPTH = 23.4

PROBE DEPTH = 1.2

SAA

T-15-50 0841

WATER DEPTH = 23.8

PROBE DEPTH = 1.4

SAA - DESC

→ PONAR ~~PHOTO 16~~

3 ATTEMPTS - NO RECOVERY

TRACE SAND IN PONAR

→ NO T-16 OR 17 TRANSECTS

DUE TO DBO LINE - DISCUSSED

W/ M. ERICKSON & M. CERDENICH

LINE CANNOT BE ACCURATELY

LOCATED & POSES RISK

(37)

B0042929 BHSF 8/30/07

T-14-10 0850

WATER DEPTH: 15.7

PROBE DEPTH: ~~17.7~~ 2.0

SANDY GRAVEL FEEL

→ PONAR PHOTO # 16

- ROCK / GRAVEL TRACE SAND

T-14-20 0901

WATER DEPTH = 17.7

PROBE DEPTH = 1.0

SAA - HARD BOTTOM

T-14-30 0909

WATER DEPTH: 20.0

PROBE DEPTH: 0

ROCKY FEEL

T-14-40 0912

WATER DEPTH: 20.2

PROBE DEPTH: 0

SAA

T-14-50 0917

WATER DEPTH = 22.0

PROBE DEPTH 0

SAA

(38)

B0042929 BASF 8/30/07

T-13-10 0921
WATER DEPTH 16.7
PROBE DEPTH = ∅
ROCK / GRAVEL FEEL

T-13-20 0923
WATER DEPTH: 18.8
PROBE DEPTH: 0.1
SAND / GRAVEL FEEL

T-13-30 0926
WATER DEPTH: 22.4
PROBE DEPTH: 1.8
SAND GRAVEL OVER STIFF
CLAY FEEL

T-13-40 0931
WATER DEPTH = 23.8
PROBE DEPTH = 0.2
SAND/GRAVEL FEEL OVER
HARD BOTTOM

PONAR @ T-13-30 PHOTO # 17
SOME MED TO COARSE SAND
(BROWN), GRAVEL MED TO COARSE/
ROCKS

(39)

B0042929 BASF 8/30/07

T-13-50 0935
WATER DEPTH: 24.3
PROBE DEPTH - 0.3
SAND GRAVEL / HARD BOTTOM
FEEL

T-12-10 0940
WATER DEPTH: ~~16.9~~ 17.8
PROBE DEPTH - 0.5
SAND GRAVEL / COBBLE

T-12-20 0945
WATER DEPTH = 19.2
PROBE DEPTH - 0.4
SAA

T-12-30 0952
WATER DEPTH: 20
PROBE DEPTH: 0.1
SAA (DESC)

T-12-40 0956
WATER DEPTH - 20.5
PROBE DEPTH - 0.3
SAA

(40)

B0042929 BASF 8/30/07

T-12-50 1004
WATER DEPTH : 21.9
PROBE DEPTH : Ø
HARD BOTTOM

T-11-10 1012
WATER DEPTH = 19.9
PROBE DEPTH = 0.1
SAND/GRAVEL/COBBLE FEEL

T-11-20 1015
WATER DEPTH = 21.1
PROBE DEPTH = ~~22.Ø~~ 0.9
SAND GRAVEL OVER STIFF
CLAY FEEL

T-11-30 1022
WATER DEPTH : 22.Ø
PROBE DEPTH : 0.5
SAND GRAVEL OVER STIFF CLAY FEEL

T-11-40 1025
~~PROBE~~ WATER DEPTH : 22.2
~~WATE~~ PROBE DEPTH : ~~22.2~~ 1.0

(41)

B0042929 BASF 8/30/07

PONAR T-11-40 PHOTO #18
BR. MED-COARSE/SAND
MED-COARSE GRAVEL
TRACE SILT

T-11-50 1031
WATER DEPTH = 22.6
PROBE DEPTH = 0.1
SAME AS ABOVE (SAM)

T-10-10 1040
WATER DEPTH = 16.4
PROBE DEPTH = Ø
SAND/GRAVEL COBBLE FEEL?

T-10-20 1042
WATER DEPTH : 19.8
PROBE DEPTH : 0.2

T-10-~~30~~ 40 1048
WATER DEPTH = 22.2
PROBE DEPTH : 1.1
SAME AS T-10-30

B0042929 (42) BASF 8/30/07

T-10-~~40~~ 30 1045
WATER DEPTH = 21.2
PROBE DEPTH = ~~22.9~~ 1.7
SAND GRAVEL FEEL OVER
STIFF CLAY

T-10-50 1059
WATER DEPTH 23.0
PROBE DEPTH - 0.9
SAND GRAVEL FEEL

PONAR T-10-30 PHOTO#19
- 1 - LARGE ROCK - TRACE
SAND - 1.7' OFF PROBE
DEPTH POTENTIALLY BETWEEN
ROCKS
- 3 PONAR ATTEMPTS

~~T-10-50~~
~~WATER DEPTH = 23.0~~ TW
~~PROBE DEPTH =~~

TW

B0042929 (43) BASF 8/30/07

T-9-10 1109
WATER DEPTH 18.0
PROBE DEPTH 0-2
SAND / GRAVEL / COBBLE
FEEL

T-9-20 1112
WATER DEPTH - 20.0
PROBE DEPTH - 0.2
SAND (DENSE)

T-9-30
WATER DEPTH = 22.8
PROBE DEPTH = 0.4
SAND GRAVEL FEEL

T-9-40
WATER DEPTH: 23.2
PROBE DEPTH: 0.4
SAND

T-9-50
WATER DEPTH 23.5
PROBE DEPTH = 0.3
SAND

(44)

B0042929 BKSF 8/30/07

T-8-10 1136

WATER DEPTH =17.9

PROBE DEPTH 0.3

SAND/GRAVEL OVER STIFF

CLAY FEEL

T-8-20

WATER DEPTH 19.0

PROBE DEPTH 0.2

SAND (LOOSE)

T-8-30 1144

WATER DEPTH: 22.0

PROBE DEPTH: 0.8

GRAVEL/SAND OVER STIFF

CLAY FEEL

T-8-40 1153

WATER DEPTH - 23.0

PROBE DEPTH - 0.8

SAND

1200 REC'D CALL FROM M.

GUARDOUCH - ~~GAUGE UPDATES~~

1210 REVIEWED TAILGATE SAFETY FORM

& DISCUSSED

(45)

B0042929 BKSF 8/30/07

T-8-50 1221

WATER DEPTH = 24.0

PROBE DEPTH: 0.9

SOME SAND GRAVEL OVER

STIFF CLAY FEEL

T-7-10 1240

WATER DEPTH = 19.5

PROBE DEPTH = 1.3

SAND/GRAVEL FEEL

T-7-20 1244

PROBE DEPTH: 21.5

WATER DEPTH: 0.4

SAND/GRAVEL/COBBLE FEEL

PONAR T-7-10 PHOTO-20

MED. COARSE GRAVEL/

TRACE COARSE SAND/ TRACE

GRAY CLAY / SOME BRICK

(46)

B0042929 BASF 8/30/07

T-7-30 1252
WATER DEPTH: 24.2
PROBE DEPTH: 0.8
SAME AS PONAR

T-7-40 1256
~~PROBE~~ WATER DEPTH: 25.0
PROBE DEPTH: 0.5
STIFF CLAY FEEL

T-7-50 1300
WATER DEPTH: 25.5
PROBE DEPTH: 0.8
SAA (LOOSE)

T-6-10 1306
WATER DEPTH: 20.8
PROBE DEPTH: 1.4
SAND GRAVEL OVER STIFF
CLAY FEEL

T-6-20 1309
WATER DEPTH: 22.4
PROBE DEPTH: 0.8

(47)

B0042929 BASF 8/30/07

T-6-10 PONAR 8 HD 21
→ + 3 ATTEMPTS
→ MED - COARSE GRAVEL/
TRACE GR. SAND
ROCK

T-6-30 1316
WATER DEPTH: 24.9
PROBE DEPTH = 1.0
SAND/GRAVEL OVER STIFF
CLAY FEEL

T-6-40 1320
WATER DEPTH: 25.3
PROBE DEPTH = 0.7
SAA (MOSTLY STIFF CLAY
BENEATH SAND/GRAVEL) FEEL

T-6-50 1329
WATER DEPTH: 25.2
PROBE DEPTH: 0.7
SAA

1352 RETURN to DOCK

(48)

80042929 BASF 8/30/07

1400 - 1459 T.W. MET w/ GERDOVICH - DISCUSSED RESULTS - THURS VIA PHONE w/ L TOMLINSON & M. ERICKSON - GAUGE PROBE RESULTS. ALL PROBING COMPLETE

M.T. & J.G. SET UP BOAT FOR VIBRACORE

MAY COLLECT 6 VIBRACORES @ T-19-40, T-20-100 T-28-100, T-1-50, T-29-30, & T-2-30 if TIME PERMITS

- T-29-30 NEAR DEQ LOCATION 3

(49)

80042929 BASF 8/30/07

1505 DEPART DOCK TO T-1-50 VIBRACORE

PHOTO	VIEW	COMMENTS
21	NW	SET UP T-1-50 VIBRACORE
22	↓	↓

10' LONG ALUMINUM CORES
1ST ATTEMPT - NO RECOVERY
2ND - 10' PENETRATION APPEARS TO BE 7-8' OF OF RECOVERY

NEED TO PURCHASE ADD. TOOLS TO SPLIT CORE TO HAVE SIMILAR SAMPLE TO SPLIT SPOON

HEAD BACK TO DOCK

1640 TURN IN HOT / SAFE WORK PERMIT TO BASF - JOHN MICHAEL - MET w/ TOM & JUDY OF URBAN ENG & ALSO CALLED M. ERICKSON w/ UPDATES & M GERDOVICH - 1701 All OFF SITE

[signature]

B0042929 BASF 8/31/07

WEATHER: HIGH 60s, P. CLOUDY

LEVEL D 1fES

TASK: SEDIMENT STUDY OFF SHORE OF NORTH WORKS

0658 T. WHARTON, T. MATTISON & J. GUTKOWSKI ON SITE TO COMPLETE VIBRACORING

MET W/ JERRY SMITH (BASF) OBTAINED SAFE / HOT WORK PERMIT - T.M. & J.G. SET UP SURVEY CONTROL

T.W. CONDUCTS TAILGATE SAFETY MEETING - SEE FORM - 0721

0809 DEPART DOCK -

RECEIVE CALL FROM L. TOMLINSON ORDER OF VIBRACORES:

T-29-30

T-20-10

T-19-40

T-20-100

T-24-10 } IF TIME PERMITS

T-28-100 }

B0042929 BASF 8/31/07

MOVE TO T-29-30 0835

3 - ATTEMPTS - NO RECOVERY PENETRATED ~ 6' - HARD BOTTOM - CORE HAD ORGANIC ODOR.

- CALLED PM ERICKSON - WILL SUBSTITUTE W/ T-29-75 - WHERE PROBE DEPTH WAS GREATER (12')

T-29-75 DTW - 16.7 0910

1st ATTEMPT - ~7.8' RECOVERY

- WILL COLLECT ALL CORES THEN CUT & DESCRIBE

CALLED ERICKSON - AIM FOR > 3 FEET RECOVERY & 3 ATTEMPTS

T-20-10 0933 DTW 18.2

~ 1 ATTEMPT ABOUT 4.3' RECOVERED

T-19-40 1004 DTW = 24.8

1st ATTEMPT: ϕ RECOVERY

2ND @ 1025 = ~8' RECOVERY

- ODOR

(52)

B0042929 BASF 8/31/07

T-20-100 DTW: 28.2/1021

M. GERDENICH WATCHING FROM SHORE - CALLS TW - ASKS TO PHOTO & GAUGE NEXT TO CONCRETE SEAWALLS SOUTH OF T-20 LOCATIONS

T-20-100

1ST ATTEMPT = Ø RECOVERY

2ND ATTEMPT = Ø RECOVERY

3 ATTEMPT ~ 5.5' RECOVERY

SEAWALL NEAR SIGN

PHOTO'S 23, 24, 25, 26, 27, 28

11' DEPTH OF WATER

@ 24-10 ARMY CORPS BARGE IS IN WAY - M. GERDENICH LEFT V/M w/ USEPA - CALLS RICH (DEC) NEXT BEST LOCATION IS 25-20

(53)

B0042929 BASF 8/31/07

25-20 1140 DTW: 13.4

PHOTO 29 - ARMY CORPS BARGE @ 24-10

- 1ST ATTEMPT - Ø RECOVERY

2ND ↓ ↓

MOVE EAST 25-30

25-30 DTW 14.5

(2) ATTEMPTS NO RECOVERY

GERDENICH OBSERVED - PERMISSION TO MOVE TO 25-50

25-50 1220 DTW 17.3

- 5.5' RECOVERY

PHOTOS 29, 30, 31, 32

0-2

CUT OPEN CORE w/ SHEAR - T-25-50

0-2' - GRAY / BROWN SILT - FINE - MED SAND √ ODOR, SHEEN

2.5-2.9 - SAA w/ SOME COARSE GRAVEL

~~2.9-4 5.5 - same~~ T-25-30 CONT'D

2.9-4.5 - SAME AS 0-2'

4.5-5.0 = GRAY, SILT-FINE TO MED SAND

5-5.5 GRAY - MED-COARSE SAND (TIGHT)

T-29-75

7.8' RECOVERY

PHOTOS - 33(TOP) 34, 35, 36, 37 (BOTTOM - 38 (5.8-7.8)

0-2.8 GRAY SILT, ODOR

2.8-7.8 GRAY SILT w/ FINE TO MED. SAND

T-1-50

PHOTOS - 39 (BOTTOM), 40, 41, 42, 43, 44, 45

0-2.5 DARK GRAY SILT - FINE - MED SAND (TRACE) TRACE FINE GRAVEL / ODOR

NOTE: STICK - 0' IS AT BOTTOM

2.5-3.5 DARK GRAY/BLACK MED - COARSE SAND, SOME FINE GRAVEL / MOD. ODOR

3.5 GRAY/BROWN CLAY HIGH PLASTICITY

T-19-40 6.6' RECOVERY

PHOTOS - 46 (TOP), 47, 48, 49, 50, 51

- SURVEY STICK - 0' IS AT TOP

0-0.4 - GRAY SILT / MED SAND / FINE MED GRAVEL

0.4-2.4' - COARSE SAND (DARK GRAY) w/ FINE - MED GRAVEL

(56)

B0042929 BASF 8/31/07

2.4-3.2 - GRAY SILT (DARK) w/ MED SAND / TRACE FINE GRAVEL

3.2-6.6 - BR MED-COARSE SAND / FINE-MED GRAVEL w/ SHELLS

T-20-100 5.7' RECOVERY
PHOTOS 52 (TOP), 53, 54, 55, 56, 57, 58, 59 (1-2' COMPOSITE)

0-2.8 LT. GRAY SILTY MATERIAL / SOME FINE-MED SAND / TRACE GRAVEL

2.8-3.4 - LT. GRAY - MED-COARSE SAND / TRACE FINE-MED GRAVEL

3.4-3.5 - GRAY COARSE SAND w/ MED. COARSE GRAVEL

3.5-4.5 SAME AS 2.8-3.4

(57)

B0042929 BASF 8/31/07

T-20-100 CONT'D

4.5-5.7 - BR, MED-COARSE SAND w/ MED-COARSE GRAVEL

* NOTE: 0-2.8 - FOUL (FISH-LIKE) ODOR

T-20-10 4.7 RECOVERY
PHOTOS - 60 (TOP), 61, 62, 63, 64, 65, 66, 67, 68 (BOTTOM)

0-4.6 - DARK GRAY SILT, SOME FINE-MED SANDS, TRACE FINE-MED GRAVEL

4.6-4.7 - LT. GRAY SILT w/ FINE SAND - NO ODOR

NOTE: 25-80, 29-75, & 1-50 PHOTOS: SURVEY ROD Ø IS AT BOTTOM OF CORE

PHOTO 69 - T-25-10 OBSTRUCTION

B0042929 BASF (58) 8/31/07

Photo 70 = ARMY CORPS
BOXES @ 24-10.50

1428 RETURN TO DOCK
TAKE DOWN VIBRACORE
DEVICE, DE PREP
BOAT -
T.W. MOBED TO MEET W/ GERDENICH
- DROPPED OFF SITE PLANS TO JEAN
MICHAEL (BASF) -
· DROPPED OFF ALUMINUM VIBRACORES
& PPE TRASH INTO DESIGNATED
BASF DUMPSTERS
· MET T.M. & J.G - BOAT OUT OF
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Review of Sedimentation Conditions in the Trenton Channel near BASF North Works

BASF Corporation
Wyandotte, MI

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1. Introduction

In a letter dated June 15, 2006, the United States Environmental Protection Agency (USEPA) communicated the following expectations to BASF:

- A "map of navigational channel that may establish whether the area adjacent to the river is a depositional area"; and

- "An evaluation of sediments that first verifies the presence/absence of sediment and if present, collect samples adjacent to the site as well as upstream and downstream to characterize sediment quality relative to background. Sediments would be analyzed for constituents including mercury."

These expectations were beyond previously discussed action items for completion of the Corrective Measures Study (CMS) for North Works (the Site). Presumably, the USEPA's intent is to assess whether the CMS should address sediments in the Trenton Channel. This assessment would apparently be based on whether the area is depositional and, if so, whether downstream sediment quality is impacted relative to upstream sediment quality. Available bathymetric charts and other information presented herein indicate that the river adjacent to the Site is not a depositional area. The scope and scale of sampling envisioned in the USEPA's request for a sampling program are unclear, but available information is sufficient to conclude that sediment quality downstream of the site is not statistically different from sediment quality upstream of the Site; in fact, higher concentrations of heavy metals, including mercury, have been observed upstream of the Site than in near-by samples downstream of the Site.

Based on a review of the existing information, a new sampling program is unwarranted for several reasons:

- There is currently sufficient information concerning bathymetry, hydrodynamics, and sediment characteristics in the upper Trenton Channel to conclude that significant deposition of sediment (especially fine-grained sediments) has not occurred over a period of over 100 years.

- Flow velocities in the upper Trenton Channel are not conducive to sediment accumulation based on comparison of both measured and simulated velocity patterns to sediment resuspension measurements conducted on Trenton Channel sediment samples– as well as reported observations concerning sediment type and thicknesses in the Upper Trenton Channel.

- Based on previous sampling programs, there are broad sediment impacts in the Trenton Channel in locations where sediment deposition occurs, including major source areas upstream of the site that are related to decades of intense industrial activity throughout the greater Detroit Area, but especially in the vicinity of the Rouge River, which contributes directly to contamination in the Trenton Channel as a result of river flow patterns.

- Existing data documents the presence of relatively high levels of heavy metals and other contaminants in sediments upstream of the Site, so detection of similar impacts near or downstream of the Site is expected (where sediment deposits have been encountered).

- Previous sampling programs that collected samples from along the Trenton Channel skipped the area near North Works – most likely because these areas appeared non-depositional. Historical samples are only available upstream and some distance downstream of the site.

Available sediment quality data in the most likely near-by depositional areas downstream of the Site, specifically in the Wyandotte Yacht Club Marina, show relatively low levels of contaminants compared to upstream locations. If North Works were potentially a major source historically, sediments downstream of this location would exhibit impacts greater than upstream levels. However, the reverse is observed.

- Prior to any actual sampling, Data Use Objectives (DUOs) and associated Data Quality Objectives (DQOs) would presumably be developed, consistent with USEPA's Quality Program. In the DUO/DQO process specific questions and associated decision criteria would need to be established. For example, in addressing a principal DUO suggested in EPA's June 15th letter – "to characterize sediment quality relative to background", the specific purpose of doing this would need to be articulated and a quantitative criteria for satisfying this would be needed for specific measures of sediment quality. Presumably a statistical test of upstream and downstream sediment quality data sets would be used to address whether or not sediment quality is statistically different from background levels. The available data indicate that heavy metal concentrations are not statistically different.

- Considering a) the variability in the existing data, b) the lack of any statistically significant trends in mean heavy metal concentrations from upstream to downstream of North Works, c) higher maximum heavy metal concentrations (including mercury) are present in upstream sediments, and d) the lack of any major sediment depositional zones adjacent to the Site; further sampling would not provide any clearer basis for a decision concerning the CMS than is already afforded by existing data.

- Even if BASF decided to include sediments in the CMS, it would be inappropriate to focus sediment characterization or remediation studies on a small area (such as the section adjacent to North Works) when the larger Detroit River system is broadly impacted. There is little justification from a risk-management standpoint for addressing low-level contamination when significant source areas exist upstream, the benefits to overall risk reduction would be negligible, and recontamination is likely.

While the USEPA's general interest in seeing further sediment characterization performed in the Trenton Channel is understandable, this sampling activity does not seem warranted for purposes of making a determination regarding the CMS. It is unclear how sediment sampling could provide new information that would substantively impact the decision on how sediments should be managed in the Trenton Channel, even aside from the CMS. Focused remedial activities in a small area would not address the widespread impairment of sediment quality from many sources and would be subject to recontamination by ongoing releases and transport from upstream areas.

2. Data Review

A review of available bathymetric records, velocity measurements, multiple modeling studies, and sediment data clearly shows that the upper Trenton Channel adjacent to the Site is a fast-flowing, non-depositional area. Available sediment analytical data show that sediment quality is similar upstream and downstream of North Works. A review and interpretation of available information is presented below.

2.1 Bathymetry

There is currently sufficient information concerning bathymetry in the upper Trenton Channel to conclude that significant deposition of sediment has not occurred over a period of over 100 years. Historical navigation charts from 1900, 1921, 1942, 1962, 1982, and 1997 provide a representative illustration of water depths during the past century in the Trenton Channel (Figures 1-3). Between 1900 and 1962, the charts reflect minimal changes in water depth along the Site shoreline through time, and bottom depths range between approximately 25 and 30 feet (ft). Starting in 1942, the charts show an area of slight shoaling at the head of Point Hennepin; although a comparison of the charts during the 55 years from 1942 to 1997 shows that water depths in this area were virtually unchanging. A sediment core that was collected from this area by Arkema, Incorporated (Arkema) in 2005 (Conestoga-Rovers & Associates [CRA], 2005) contained low mercury concentrations relative to background (these data are discussed further below).

Although the historical navigational charts are not highly detailed, they show an absence of accumulation of any appreciable amount of sediment along the Site shoreline or in the channel downstream of the Site over a period of many decades. This is consistent with modeling results and velocity measurements, which indicate that velocities are too high to permit deposition of fine-grained sediments and, therefore, contaminants (because most contaminants tend to bind with the fine fraction). A study by Szalinska et al. (2006 – in press May 2006) based on a river-wide sampling program conducted in 1999 showed a correlation between flow velocity and heavy metals contamination, with high concentrations in slow-moving areas (unlike the head of the Trenton Channel). Details and references for the modeling results and velocity measurements are provided below.

2.2 Hydrodynamics

Flow velocities in the upper Trenton Channel are not conducive to sediment accumulation based on comparison of both measured and simulated velocity patterns to sediment resuspension measurements conducted on Trenton Channel sediment samples – as well as reported observations concerning sediment type and thicknesses in the Upper Trenton Channel. A hydrodynamic model for the Detroit River is available online from the United States Geological Survey (USGS) (Hotlschlag and Koschik, 2002). BBL obtained an existing two-dimensional (2D) hydrodynamic model for the St. Clair – Detroit River Waterway from the USGS. This model, which is based on the hydrodynamic model RMA2, was developed jointly by the USGS and the United States Army Corps of Engineers (USACE) Detroit District. The RMA2 model is a 2D, depth-averaged (i.e., the model computes lateral, not vertical variations in flows), finite element, hydrodynamic numerical model routinely used by the USACE for hydrodynamic studies, sediment stability analyses, and sediment transport studies. BBL previously modified this model using the Surface Water Modeling System (SMS) to provide finer grid resolution along the shoreline of BASF's Riverview Site (the grid was not refined near North Works) and then used the refined model to evaluate hydrodynamic conditions for a Lake Erie (i.e., a standing wave in an enclosed or partly enclosed body of water) event, as well as low-flow conditions (BBL, 2006).

These simulation results were extracted to evaluate predicted velocities along the North Works shoreline under that range of flow conditions.

In preparing the hydrodynamic model, an analysis was conducted to determine the potential ranges of discharges and water levels in the Trenton Channel. The analysis involved a review of discharge and stage data collected by the USGS (USGS, 2001), the USACE (http://www.lre.usace.army.mil/greatlakes/hh), and the National Oceanic and Atmospheric Administration (NOAA; www.glerl.noaa.gov). Overall, discharge in the Detroit River has been shown to range from approximately 130,000 cubic feet per second (cfs) to 250,000 cfs, with discharge in the Trenton Channel ranging from 40,000 to 55,000 cfs. The average discharge in the Detroit River is approximately 186,000 cfs (Hotlschlag and Koschik, 2002)

Wind-generated s on Lake Erie can produce fluctuating water levels on an average of every 12 to 14 hours and can cause lake water levels to drop rapidly (several feet in less than a day). These lake level fluctuations can cause significant velocity increases in the Detroit River (Great Lakes Institute for Environmental Research [GLIER], 2002). A statistical analysis by GLIER (2002) indicates that water-level drops of 4 ft (1.25 meters [m]) to 6 ft (1.8 m) on Lake Erie's western side are expected to occur with reasonable probability every 2 to 20 years.

To evaluate a representative range of velocities and bed shear stresses in Trenton Channel low-flow and seiche conditions, two RMA2 model simulations were utilized:

- A steady-state, low-flow event with a flow in the Detroit River of 180,900 cfs and a Lake Erie water level of 570.05 feet National Geodetic Vertical Datum 1929 (NGVD29) (the model file for this event was provided online by the USGS, as described above). Note that a flow of 180,900 cfs in the Detroit River is exceeded approximately 80% of the time; and

- An event that had a 6.5-ft (2-m) lake level drop in less than a day and an approximately 3.5-ft (1-m) drop from the average water levels of the previous day.

These two flow conditions were selected because existing model simulation results were available for these conditions, and they represent a range of conditions of interest –normal flow periods that persist most of the time during which sedimentation would be most likely to occur, and high flows that could periodically remove accumulated sediment. Even if sediment accumulation occurs at low-flow, which is assessed using the low-flow simulation results, periodic seiche events or spring high flow periods may remove any accumulated sediment, which is assessed using the event simulation results.

Figures 4 and 5 show the results of the seiche and low-flow simulations, respectively. Please note that the depth-averaged velocity magnitude and direction (in feet per second [fps]) computed by the RMA2 model are shown on the left panel, and the computed bed shear stresses (in dynes per square centimeter [dynes/cm^2]) are shown on the right panel for each figure. During the low-flow event, the model predicted depth-averaged velocities to be generally between 1.2 and 2.0 fps near the shoreline. Computed bed shear stresses generally exceeded 10 dynes/cm^2 (ranging from 9 to 22 dynes/cm^2). During the event, the model predicted depth-averaged velocities generally exceeding 1.5 fps (with a maximum of 2.3 fps) along the shoreline. Computed bed shear stresses for this simulation were generally higher than 20 dynes/cm^2 (with a maximum of approximately 30 dynes/cm^2). Higher velocities and shear stresses during both events occur north of the bend in the shoreline at the Site. These velocities, for both the low-flow and simulations, are high enough to resuspend non-cohesive sands and consolidated cohesive sediments based on erosion measurements for Trenton Channel sediments (from downstream areas) reported by McNeil et al. (1996). The results indicate that hydrodynamic conditions are not conducive to sedimentation in the channel, in agreement with the bathymetric records. It should be noted that the model grid does not resolve small variations in the shoreline, or embayments such as the Wyandotte Yacht Club marina, although sediment core data are available for this particular embayment and are discussed below.

In addition to the modeling results, Acoustic Doppler Current Profiler (ADCP) measurements collected by the USGS in July 2002 (Hotlschlag and Koschik, 2003) showed flow velocities in the range of 1.5 to 3 fps (with the velocities exceeding 3 fps in many instances) at a cross section of the Trenton Channel adjacent to the Site (Figure 6). The transects were surveyed on July 15, 2002, with the flow in the Detroit River ranging from approximately 185,000 cfs to 190,000 cfs. The measurements were collected during average flow conditions during a non- event. These velocities should be considered representative of typical or average conditions in the river (higher than the low-flow event and lower than events). Available ADCP measurements were not collected during a event. Please note that two transects were surveyed by the USGS at the cross section: one in each direction across the Trenton Channel at the bend in the shoreline near the Site. The left panel shows ADCP velocity measurements looking downstream, and the right panel shows the measurements looking upstream. As shown on the figure, the highest velocities (generally between 2 and 3 fps) occur where water depths are the greatest along the Site shoreline. The highest velocity readings generally occurred in the center to upper part of the water column; however, near-bottom velocities generally exceed 2 fps. Lower velocities occurred on the opposite side of the channel in shallower areas by Grassy Island.

The predicted velocities from the hydrodynamic model agree with the ADCP measurements for the low flow conditions (see Figures 5 and 6) and show an area of locally high flow velocity along the North Works shoreline for the event (Figure 4). Calculated bottom shear stresses for both events (Figures 4 and 5) exceed measured resuspension thresholds for fine sediments from the Trenton Channel. McNeil et al. (1996) measured resuspension thresholds and erosion rates in several sediment cores collected in the Trenton Channel (downstream from the Site). At low shear stresses (6 dynes/cm^2 and less), erosion rates were relatively low at the surface and decreased with depth, while, at higher shear stresses (11 dynes/cm^2 and greater), the erosion rate was higher and relatively constant with depth. The resuspension threshold for surface sands and silts was measured at approximately 2.5 dynes/cm^2. In fact, the predicted bed shear stresses from the hydrodynamic model for both the low flow and event generally exceed the measured resuspension thresholds throughout the core. Because shear stresses exceeded 10 dynes/cm^2, even during the low flow event, this section of the Trenton Channel will not accumulate fine-grained sediments. At these flow velocities, fine grained materials are winnowed, and coarse materials left behind. Lower flow velocities may occur in eddies or along the channel margins in some areas, such as the Wyandotte Yacht Club marina; however, as discussed below, sediments in this area are similar to upstream sediments and have relatively low contamination.

This conclusion was also reached by Reitsma et al. (2002), who applied a Curvilinear Three-Dimensional Hydrodynamic (CH3D) model to simulate sediment transport during normal flow and seiche events. The model setup used sediment bed layers with various size classes of sediment that allowed removal of progressively larger material until a stable condition was reached. These authors concluded that some areas of the river will not experience net deposition of silt-sized material even during average flow. The upper Trenton Channel is one such area, and results from the model were used to classify this area as "sand, gravel, and consolidated soil." This is consistent with conclusions by Lick et al. (1987) that resuspension can occur regularly in the Trenton Channel. Energetic transport of sediments through the upper Trenton Channel is the primary reason that sediments do not accumulate there. *The Upper Great Lakes Connecting Channels Study Report* (Upper Great Lakes Connecting Channels Study [UGLCCS], 1988) summarizes the sediment thickness (glacial till is included in the description of sediment in this report) in the Detroit River as declining steadily southward from Belle Isle to "near zero in the Trenton Channel" and reported that "gravel dominated" the entrance to the Trenton Channel (located upstream of North Works).

While sediments have accumulated along the channel margins, such as in the Wyandotte Yacht Club marina (which was core sampled by the Michigan Department of Environmental Quality [MDEQ] in the 1993/96 study), direct observation shows that no major fine sediment deposits occur in the upper Trenton Channel, other than the depositional zones downstream of Mud Island (upstream of the Site) and Grassy Island, which (due to its location across the channel from the Site and the laminar flow patterns in the channel) cannot be impacted by the North Works. Dredged material from other areas placed at Grassy Island is however a potential source of contamination to downstream areas of the Trenton Channel. The U.S. Army Corps of Engineers used this island as a disposal facility to dispose of contaminated sediments dredged primarily from the Rouge River. From the years 1961 and 1982, over three million cubic yards of dredged sediments were deposited into Grassy Island. The Grassy Island disposal facility was constructed without an impermeable liner or cap. (http://www.fws.gov/Midwest/GrassyIsland). The 1993-96 MDEQ study identified six depositional areas in the Trenton Channel. Two of these areas—the Allied Fuel Oil Slip and the Nicholson South Slip—are located upstream of North Works. The first depositional area identified in the 1993-96 report downstream of North Works is the Firestone Steel Site 2.5 miles downstream.

The lack of any historical sediment samples in the main channel areas adjacent to North Works is also noteworthy and is likely due to a lack of soft sediment. This would be consistent with the information described above, which suggests that soft sediment in this area is minimal. Sediment accumulation in the upper channel is limited to the channel margins in localized eddy areas and embayments. Available historical samples downstream of North Works are from such areas (Figure 7). One sediment core (sample ID 52C1) was collected along the shoreline of North Works during the MDEQ's 1993-96 Trenton Channel Surveys (MDEQ, 1997) to a depth of 213 centimeters (cm) (6.9 ft). Another core from this study (sample ID 69C1) was collected from the Wyandotte Yacht Club to a depth of 66 cm (2.2 ft). One 2005 sediment core sample (sample ID VC18) collected by Arkema (CRA, 2005) appears to have targeted an area of apparent shoaling near the Bishop Park Dock and recovered 162 cm (5.3 ft) of sediment.

2.3 Sediment Heavy Metals Data

Existing data document the presence of relatively high levels of heavy metals and other contaminants in sediments upstream of the Site, so detection of similar impacts near or downstream of the Site is expected (where sediment deposits have been encountered). The presence of contaminated sediments in the Trenton Channel and upstream areas in the Detroit River is well documented, as previously summarized in the *Final BASF Phase I RFI Report* (QST, 1998). Numerous studies have documented the presence of highly contaminated sediments from the area adjacent to and downstream of Zug Island to the head of the Trenton Channel (e.g. UGLCCS, 1988). Historical sampling programs skipped the area adjacent to North Works, which is not surprising considering that it is non-depositional.

A 1999 sampling program involved 150 samples collected from numerous locations upstream and downstream of the Site. A draft manuscript provided by Dr. Ken Drouillard, titled *Distribution of Heavy Metals in the Detroit River* (Szalinska et al., 2006 – in press May 2006), reports that concentrations of arsenic, cadmium, copper, and mercury are frequently above Lowest Effect Level (LEL) values (89.7, 93.6, 74.8, and 81.2% of the total number of samples respectively). This paper also presents a statistical comparison of weak and strong acid extractable metals ratios (as an indicator of relative bioavailability) among different reaches of the river and evaluates correlations of these ratios with other measured parameters such as, grain size and river flow velocities. A negative correlation of the weak and strong acid extractable metal ratios with river flow velocity was noted – indicating that locations with lower flow velocities tend to have a high bioavailable fraction of metals present in the sediments. This suggests that, in addition to the high flow velocity areas at the head of the Trenton Channel being unfavorable to deposition, any metals that are present in the sediment would have relatively lower bioavailable fractions (and potentially relatively lower toxicity as a result) than areas with fine-grained sediment upstream and downstream. The statistical analysis (ANOVA $p>0.05$) by Szalinska et al., 2006 (in press May 2006), revealed that the weak and strong acid extractable metal ratios were homogeneously distributed in the river – in other words there were no statistically-discernable trends in relative bioavailability of heavy metals in the river, which is not surprising given the number of sources along both the Michigan and Ontario shorelines. A review of metals concentrations exceeding LEL values by these authors indicates that exceedances for six or more metals at a single station is frequent among samples from the area between Zug Island and Grassy Island and in the lower Trenton Channel. The paper concludes that metals contamination is mostly confined to the lower reaches of the river and is being maintained by inputs of metals and storage in depositional areas (Szalinska et al., 2006 – in press May 2006).

2.4 Source Areas

Based on previous sampling programs, there are broad sediment impacts in the Trenton Channel in locations where sediment deposition occurs, including major source areas upstream of the site that are related to decades of intense industrial activity throughout the greater Detroit Area, especially in the vicinity of the Rouge River, which contributes directly to contamination in the Trenton Channel as a result of river flow patterns. Due to the multiplicity of industrial sources (Figure IX-15, Attachment 1), municipal dischargers (Figure IX-16, Attachment 1) located upstream of the Trenton Channel (Figure 9 and Figure IX-16 in Attachment 1), and combined sewer overflows (Figure IX-17 in Attachment 1), there would be no utility for a localized nature-and-extent investigation near North Works when the zone of likely impacts extends down into the Trenton Channel from upstream of the Site, even if the upper Trenton Channel were depositional in this area (which data indicate is not the case, as described above).

Numerous publications and journal articles document the extensive impacts of discharges from the Rouge River, and from industrial complexes on and near Zug Island, that extend downstream in the Trenton Channel. Dye trace studies show that the Detroit Waste Water Treatment Plant plume (and plumes from other sources in the vicinity of Zug Island) flow primarily into the Trenton Channel (Figure IX-5, Attachment 1). As a result, potential historical contributions of heavy metals and other contaminants from the Site would be indistinguishable from, and highly commingled with, impacts of upstream sources.

As indicated by the USEPA June 15, 2006 letter excerpt (page 1), potential releases of mercury from the Site have received particular consideration by the USEPA. Large quantities of mercury were not used at North Works (chlorine manufacturing through the mercury cell process did not occur at North Works). Consequently, any potential impacts on mercury levels in sediment from North Works would be relatively low. Upstream contributions of mercury are well documented. A summary of mercury data from the 1999 samples in the *Detroit River Modeling and Management Framework Report* (GLIER, 2002) notes that a "distinct cluster of highly contaminated sediments" occurs at the head of the Trenton Channel, at locations upstream of the Site (Figure 8).

BBL derived a dataset from the Beak investigation (Beak, 1993), the 1993-96 MDEQ study (MDEQ, 1997), the 1999 GLIER sediment study (GLIER, 2002), and Arkema's sediment core collected near Portofino (CRA, 2005). The dataset used analytical results for ten metals from 17 sampling locations upstream of North Works to Zug Island (23 total samples) (Table 1) and eight sampling locations between North Works and BASF's South Works Facility (14 samples total, including North Works) (Table 2). These sampling locations are shown on Figure 7. A statistical comparison (ANOVA $p>0.05$) of 23 upstream samples and the 14 downstream samples, including North Works, is presented in Table 3. Results of this combined dataset show that the maximum, average, and geometric mean concentrations of mercury, cadmium, chromium, copper, iron, lead, manganese, nickel and zinc are higher upstream than downstream of North Works. The only metal with an average and geometric mean greater downstream was arsenic; however, these statistics were skewed high due to the maximum arsenic concentration of 37 milligrams per kilogram (mg/kg) at sampling location 100, located east of Pt. Hennepin. However, the difference in the metals mean concentrations upstream and downstream of North Works are not statistically significant (note that arsenic is just above the threshold with p=0.051).

When further assessing the mercury data, sediment samples from areas immediately downstream of North Works contain lower mercury concentrations than upstream areas, and mercury concentrations are low compared to screening levels for dredged material management. The Ontario Ministry of Environment (MOE) screening levels for mercury are provided in the table below.

Criteria	Mercury Concentration (mg/kg)
Lowest Effects Level (LEL)	0.2
Severe Effects Level (SEL)	2

One sample collected near the mouth of Ecorse Creek (located upstream) in 1991 by Beak Consultants Limited (1993) contained 11.7 mg/kg mercury. The most recent available sample downstream of the Site was collected by Arkema near the Bishop Park Dock, located between the Wyandotte Yacht Club and Portofino (upstream of BASF's South Works Facility) and contained an average concentration of 0.026 mg/kg mercury. The highest detected concentration of mercury between North Works and Arkema's East Plant shoreline was 1.5 mg/kg in one core sample collected from the Wyandotte Yacht Club during the 1993-96 study. Samples from this same study collected upstream of North Works at the Stenson Club contained mercury concentrations as high as 3.0 mg/kg.

3. Summary

The USEPA's June 15, 2006 request for information concerning sedimentation conditions in the Trenton Channel adjacent to North Works and an assessment of differences in upstream versus downstream sediment quality can be fulfilled with the review of available information, as presented above.

After reviewing the available information concerning hydrodynamics, sediment physical characteristics, sedimentation, and sediment quality data in the upper Trenton Channel, BBL concludes that the sediment sampling activities requested by the USEPA would not provide new or useful additional information concerning sediment quality in the upper Trenton Channel. It is not a depositional area. For purposes of addressing whether to include sediments in the CMS, the available information does not support doing so, as concluded in the *Final Phase 1 RFI Report* (QST, 1999), which was previously accepted by USEPA.

Sediment issues for the Trenton Channel at large must deal with a multiplicity of contaminants and ongoing sources. The available data suggest that sediments impacts downstream of North Works are part of continuum of a broadly impacted area extending downstream from the Rouge River area into the Trenton Channel. Higher concentrations occur in depositional areas found primarily in the lower reaches. Historical contributions in these areas are commingled due to the history of the area and transport dynamics in the Trenton Channel.

Historical data document the presence of contaminated sediment along the entire Michigan shoreline from Zug Island to the Detroit River mouth due to the historical and continuing sources. Available sediment samples along the shoreline downstream of the Site contain relatively low mercury concentrations. Any additional sampling would not distinguish any potential releases from the Site due to the presence of sediments with higher mercury (and other heavy metal) concentrations immediately upstream. Any mercury or other heavy metals detected would be a result of many highly commingled sources.

In addition, although upstream sources continue, long-term declines in fish tissue mercury concentrations led to removal of the fish consumption advisory for walleye based on data collected from the nearby Grassy Island monitoring station (MDEQ, 2003; Michigan Department of Community Health, 2003). This suggests that mercury concentrations in the water column and surficial sediments overall are improving. Hamdy and Post (1985) compared 1970 and 1980 sediment mercury data and made early observations that mercury levels in sediments were declining as well. From an overall human health risk perspective (as related to bioaccumulation of mercury in fish tissue in the Detroit River) there is little justification for sediment investigations focused on mercury when other bioaccumlative chemicals are more prominent in the food chain at levels exceeding consumption advisory thresholds.

A recent paper by Drouillard et al. (2006) notes widespread polychlorinated biphenyl (PCB) and polycyclic aromatic hydrocarbon (PAH) sediment contamination in the Trenton Channel and concludes that active sources and remobilization of particles from within the watershed continue to deposit PCBs and PAHs. In the context of contaminated sediment risk management, it is necessary to consider potential impacts from continuing sources of all contaminants, not mercury alone. For example, all fish species listed for consumption advisories by the Michigan Department of Community Health (MDCH) are listed for PCBs. Only one species, (freshwater drum) is listed for mercury. Focused remediation of mercury hot-spots would do little to reduce river-wide risks posed by the more prevalent and persistent compounds. This further erodes any basis for focused sampling in the upper Trenton Channel independent of a river-wide program.

It is appropriate to consider the USEPA's request for sampling alongside USEPA guidance for design of sediment sampling activities that recommend establishing DUOs and DQOs by following the USEPA seven-step process (USEPA, 2006). Formulation of logical DUO and DQOs in the context of addressing data needs to support a determination regarding the inclusion of sediments in the CMS does not lead to a need for further sampling to compare upstream and downstream sediment quality in light of what is currently known. First, if the terminology "background" is synonymous with "upstream", one would expect additional sampling to provide similar results to the statistical comparison of mean metals concentrations upstream and downstream of the site, as exists in available data, and would provide no new useful information. If "background" is considered a regional value, comparison of upstream and downstream results with the background value would indicate similar levels of impairment relative to regional background – which is already evident in existing data. Based on the lack of sedimentation, it is not logical to expect useful results for sampling adjacent to North Works; therefore, sampling would presumably address depositional areas farther downstream in the Trenton Channel, which are also the first depositional areas downstream of the major source areas located upstream of North Works to Zug Island. Sediment impacts in these areas are a result of numerous commingled sources. The USEPA's guidance on remediation of contaminated sediment sites stresses the importance of source control as the initial step in remediation (USEPA, 2005). It is inappropriate to focus simply on addressing whether or not sediments should be included in the CMS based only on upstream and downstream sediment quality comparisons without also defining the basic expectations on how potential risks posed by sediments would be managed programmatically. With numerous ongoing sources upstream of North Works, and relatively low levels of sediment contamination at available sampling points downstream of North Works, it would be imperative to address the sediment issues more comprehensively. Otherwise, any sediment management efforts could result in no actual benefit in terms of risk reduction. As previously asserted in the *Final BASF Phase I RFI Report* (QST, 1998), any further sampling should be done under broader programs for the Detroit River Area of Concern.

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Tables

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TABLE 1

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

METAL CONCENTRATIONS UPSTREAM OF NORTH WORKS

Sample Location ID	Date Collected	Depth (cm)	Depth (cm)	Mercury	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
Station 26	1991	Ponar		0.53	11.3	28.67	170	163	143000	127	1233	61	550
Station 62	1991	Ponar		0.6	14	8.8	260	220	90000	220	770	130	590
		0	30	0.73	6.3	10	170	130	32000	160	740	81	600
		30	91	0.83	7.8	12	180	190	34000	210	690	87	600
		91	152	1.5	10	13	190	250	33000	230	540	110	650
		152	213	3	14	3.6	47	300	18000	250	410	19	390
59C1 Stenson Club	1993-1996	213	224	2.1	13	2.5	28	160	14000	130	290	16	210
64P Mud Island Northside	1993-1996	0	30	0.08	3.4	3.3	28	23	23000	22	250	24	97
65P Mud Island SW	1993-1996	0	30	0.33	4.1	7.1	54	71	38000	71	500	35	250
		0	30	0.23	2.5	2	17	18	13000	12	190	13	48
		30	91	0.17	2.9	1.9	15	15	13000	10	250	15	50
60C1 Mud Island Southside	1993-1996	91	137	0.08	2.4	2.1	16	14	14000	9	320	14	35
Station 75	1991	Ponar		11.7	7	1.4	81	100	55000	90	670	42	350
57 P Mouth of Ecorse Creek	1993-1996	Ponar		0.4	7.1	5.6	57	66	30000	81	590	37	270
58 C1 Mouth of Ecorse Creek	1993-1996	0	30	<0.1	3.1	1.9	16	25	13000	11	160	39	45
Station 34	1991	Ponar		0.22	6.3	1.1	66	72	60000	94	550	37	280
076	1999	Ponar		0.57	5.5	4.0	98	134	56770	103	801	60	549
057	1999	Ponar		0.04	1.4	0.53	17	50	16936	7.0	333	14	42
075	1999	Ponar		0.19	4.9	3.4	101	193	NA	87	1115	57	415
079	1999	Ponar		0.42	3.9	3.2	78	111	54181	86	573	45	370
080	1999	Ponar		0.41	4.5	3.3	63	99	49773	81	685	45	385
077	1999	Ponar		0.15	1.9	2.2	16	28	13881	31	141	14	61
078	1999	Ponar		0.24	3.5	1.1	21	37	18537	18	279	20	82
			n	23	23	23	23	23	22	23	23	23	23
			Arithmetic Mean	1.07	6.1	5.3	78	107	37867	93	525	44	301
			Geometric Mean	0.38	5.0	3.4	52	75	29436	57	448	35	202
			Maximum	11.7	14	28.7	260	300	143000	250	1233	130	650
			Minimum	0.04	1.4	0.5	15	14	13000	7	141	13	35
			Standard Deviation	2.42	3.9	6.2	70	82	31207	77	291	32	217

Notes:

1. 1993-96 data taken from *Results of the Trenton Channel Project Sediment Surveys 1993-1996* , prepared by Arthur Ostaszewski, Michigan Department of Environmental Quality, Surface Water Quality Division. Data is shown in table exactly as it appears in report.
2. 1991 data taken from *Environmental Assessment of Detroit River Sediments and Benthic Macroinvertebrate Coummunities - 1991, Volume I,* prepared by Beak Consultants Limited.
3. 1999 data taken from Detroit River Modeling and Management Framework, Interpretive Report (DRAFT), prepared by Great Lakes Institiute for Environmental Research.
4. For calculation of statistics, a value of one-half of the detection limit was used for non-detect concentrations.
5. < - Undetected. The analyte was analyzed for but not detected; the associated value shown is the Practical Quantitation Limit.
6. NA - not available
7. cm - centimeters
8. All concentrations are in milligrams per kilogram.

TABLE 2

BASF CORPORATION
WYANDOTTE, MICHIGAN
UPPER TRENTON CHANNEL SEDIMENT DATA

METALS DATA AT AND DOWNSTREAM OF NORTH WORKS

Sample Location ID	Date Collected	Top Depth (cm)	Bottom Depth (cm)	Mercury	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Zinc
		0	30	0.84	9.9	9.4	120	120	30000	120	420	67	290
		30	91	1.3	15	10	110	160	30000	110	460	59	320
		91	152	1.5	15	13	77	130	27000	140	420	44	360
52 C1 BASF Northworks lower	1993-1996	152	213	0.89	7.4	4	23	74	13000	90	280	17	180
		0	30	1.1	8.2	5.9	85	120	19000	150	260	44	330
69 C1 Wyandotte Yacht Club	1993-1996	30	66	1.5	8.5	5.5	68	110	19000	150	250	35	310
		0	61	0.041 J	6.9	0.5	15.3	23.6	17900	12.5	365	24.1	59.5
		61	122	0.017 J	5.8	ND(0.095)	16	19.4	19700	8.9	398	26.8	49.1
VC-18	2005	122	162	0.021 J	5.2	ND(0.095)	17.9	23.1	22900	10.1 J	462	31.7 J	40.7
67 C1 Portofino	1993-1996	0	30	0.75	7.5	5.7	68	83	22000	220	310	39	350
43 P Portofino Slip	1993-1996	0	30	0.32	5.8	2.9	40	49	25900	143	455	27	245
98	1999	Ponar		0.039	3.2	0.85	19	28	18225	9.8	354	24	180
100	1999	Ponar		0.22	37	2.4	21	32	18297	14.6	308	21	73
Station 36	1991	Ponar		0.34	7.5	1	67	66	69000	93	670	41	310
n				14	14	14	14	14	14	14	14	14	14
Arithmetic Mean				0.63	10.2	4.4	53	74	25137	91	387	36	221
Geometric Mean				0.29	8.4	1.9	41	59	23067	54	373	33	175
Maximum				1.5	37	13	120	160	69000	220	670	67	360
Minimum				0.017	3.2	ND (0.095)	15	19	13000	8.9	250	17	40.7
Standard Deviation				0.56	8.3	4.1	36	47	13557	69	110	14	122

Notes:
1. 1993-96 data taken from *Results of the Trenton Channel Project Sediment Surveys 1993-1996*, prepared by Arthur Ostaszewski, Michigan Department of Environmental Quality, Surface Water Quality Division. Data is shown in table exactly as it appears in report.
2. 1991 data taken from *Environmental Assessment of Detroit River Sediments and Benthic Macroinvertebrate Coummunities - 1991, Volume I,* prepared by Beak Consultants Limited.
3. 1999 data taken from Detroit River Modeling and Management Framework, Interpretive Report (DRAFT), prepared by Great Lakes Institiute for Environmental Research.
4. 2005 data taken from *East Plant Sediment Survey Report, Arkema Inc., Riverview/Wyandotte, Michigan*, Prepared by Conestoga-Rovers & Associates.
5. For calculation of statistics, a value of one-half of the detection limit was used for non-detect concentrations.
6. J - estimated concentration
7. ND ( ) - Not detected above the value in parenthesis.
8. NA - not available
9. cm - centimeters
10. All concentrations are in milligrams per kilogram.

TABLE 3

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

METAL CONCENTRATIONS UPSTREAM AND DOWNSTREAM OF NORTH WORKS - STATISTICAL SUMMARY

Constituent (mg/kg)	ANOVA Results	
	F-value	P-value
Mercury	0.43	0.52
Arsenic	4.08	0.05
Cadmium	0.26	0.61
Chromium	1.47	0.23
Copper	1.89	0.18
Iron	2.06	0.16
Lead	0.01	0.93
Manganese	2.89	0.10
Nickel	0.82	0.37
Zinc	1.57	0.22

Notes:
1. For calculation of statistics, a value of one-half of the detection limit was used for non-detect concentrations.
2. F-value - Measurement of distance between individual distributions. If the calculated F-value is greater than the critical F-value, then the null hypothesis is rejected. The critical F-value for a p-value of 0.05 was 4.12 based on degrees of freedom and number of samples for this ANOVA test.
3. P-value - The significance level of the test for which the null hypothesis would be rejected. A p-value of 0.05 (95% confidence level) was used for this ANOVA test.

Figures

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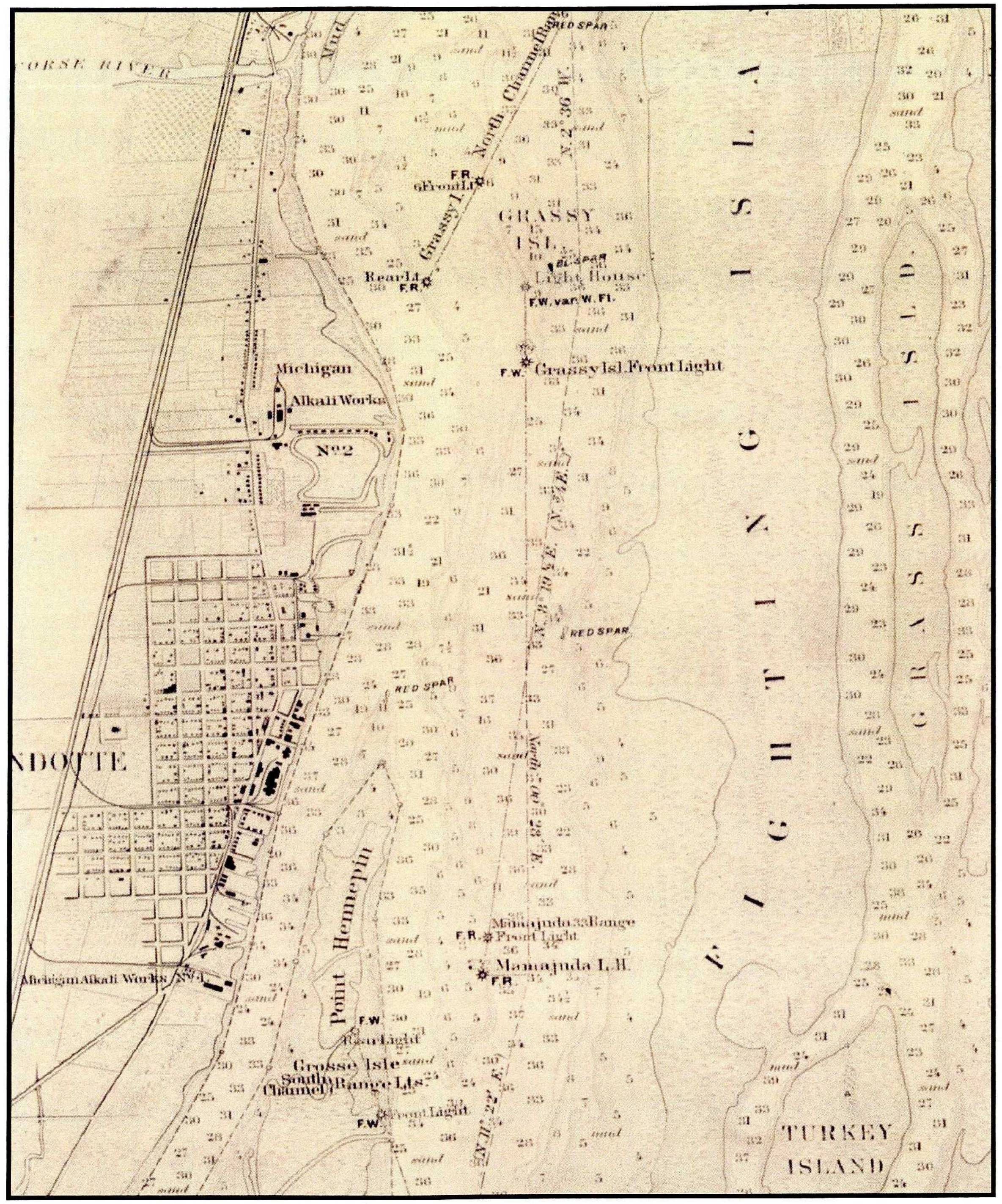

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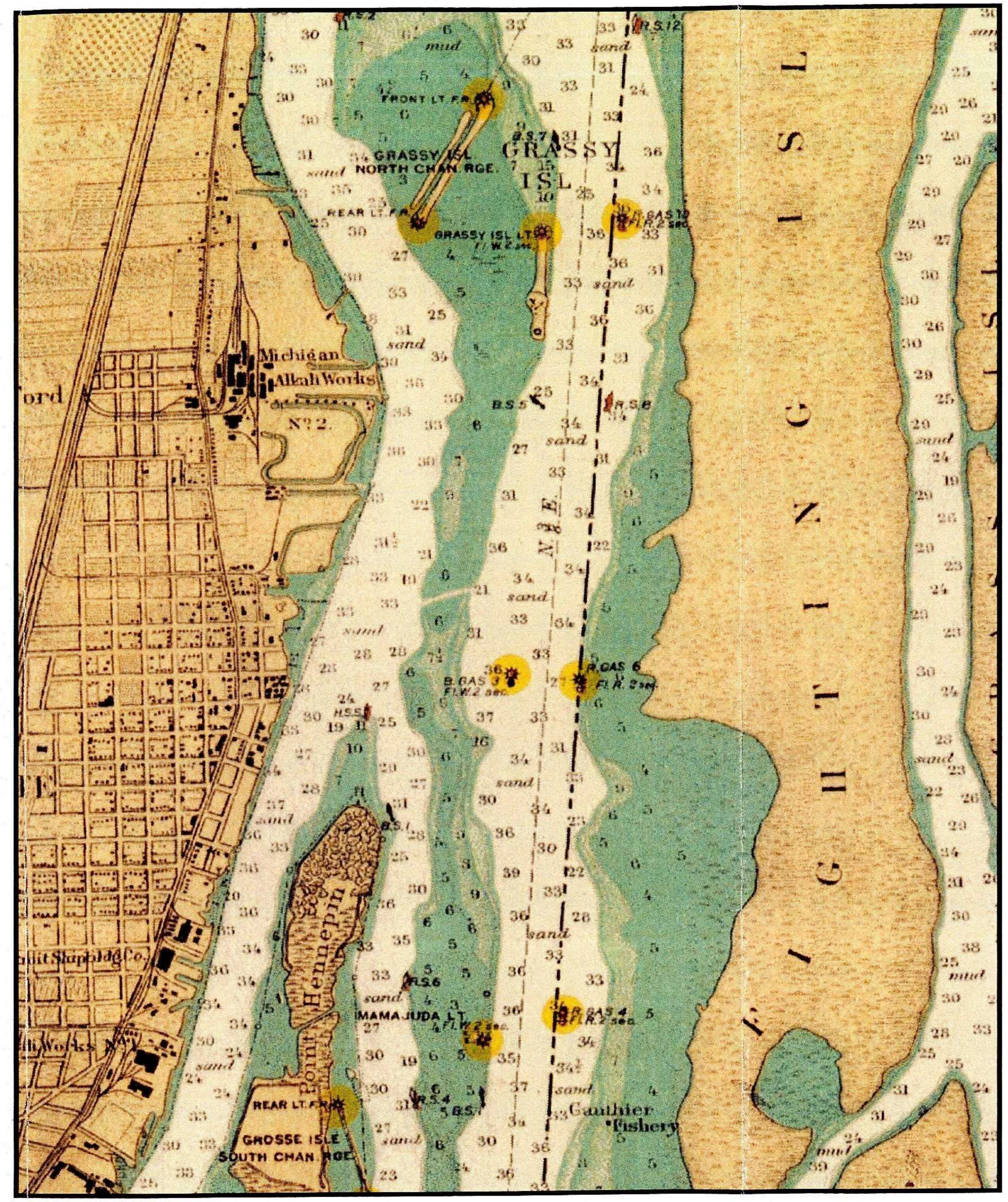

1921

NOTES:

1. HISTORICAL NAVIGATION CHARTS OBTAINED FROM Http://historical.ncd.noaa.gov/historicals/histmap.asp.
2. SOUNDINGS ON NAVIGATION CHARTS REPORTED IN FEET TO THE LOW WATER DATUM.

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

HISTORICAL NAVIGATION CHARTS 1900 - 1921

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FIGURE
1

09/12/06 SYR-D85-DLH
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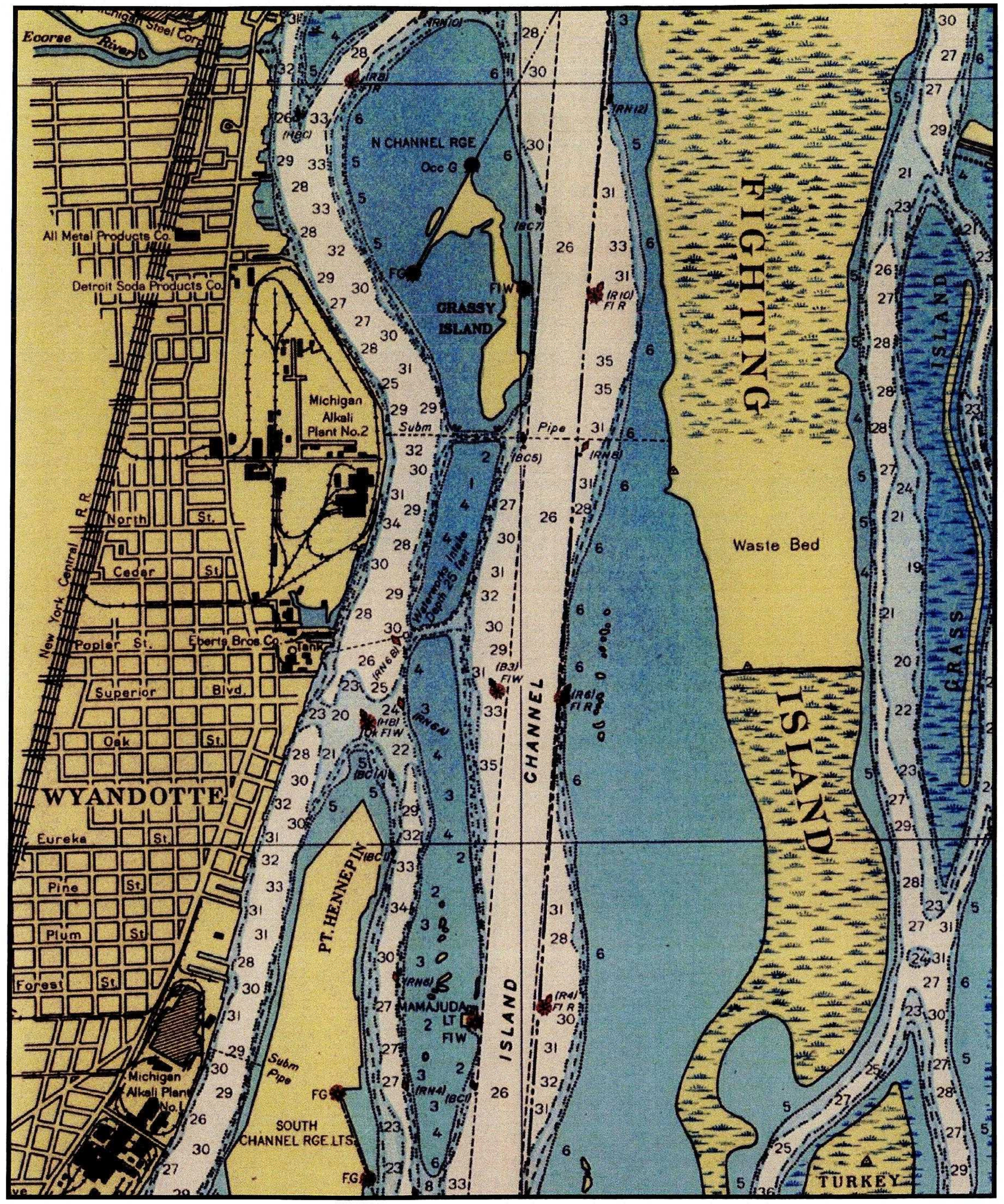

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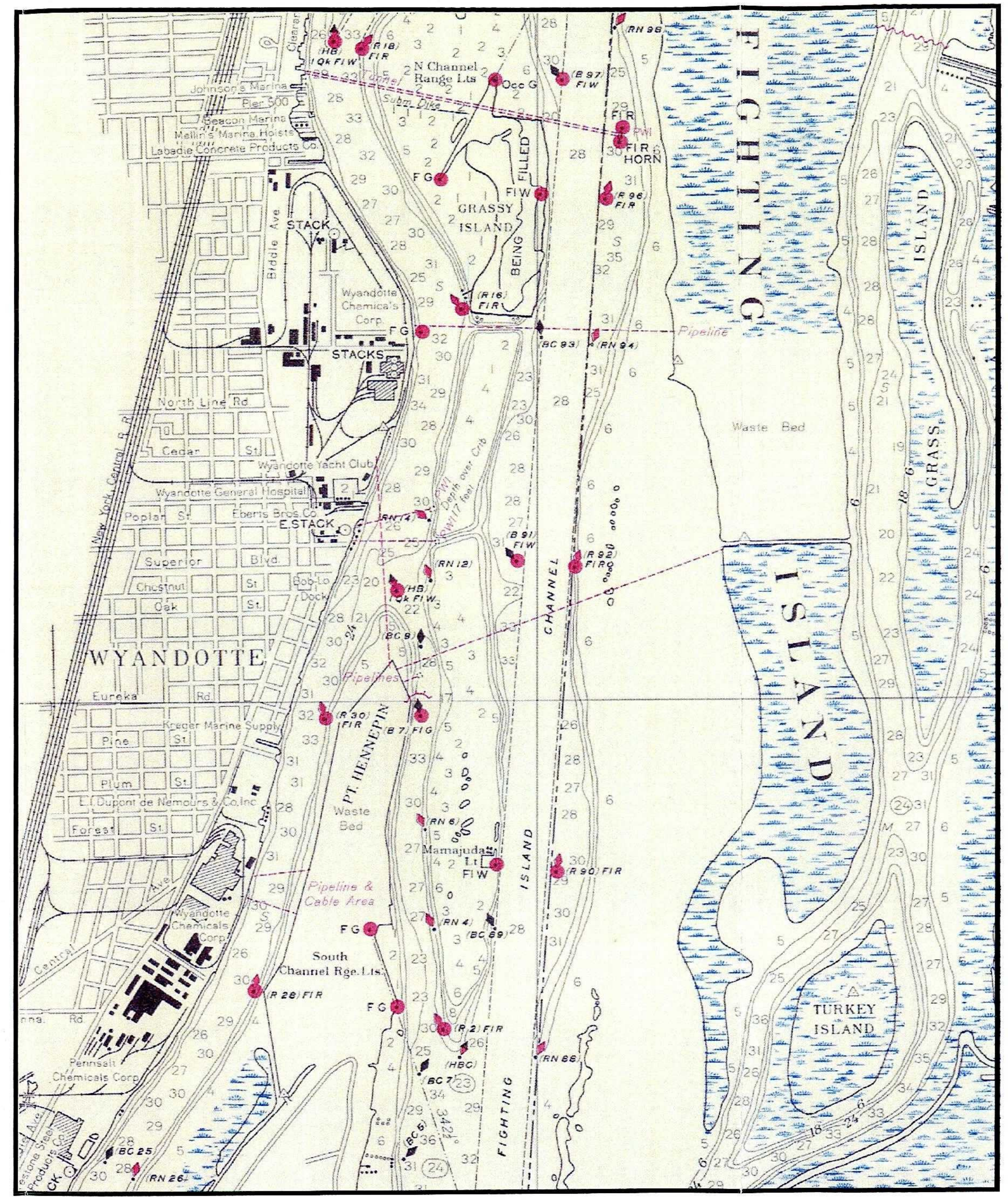

1962

NOTES:

1. HISTORICAL NAVIGATION CHARTS OBTAINED FROM Http://historical.ncd.noaa.gov/historicals/histmap.asp.

2. SOUNDINGS ON NAVIGATION CHARTS REPORTED IN FEET TO THE LOW WATER DATUM.

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

HISTORICAL NAVIGATION CHARTS 1942 - 1962

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FIGURE
2

09/12/06 SYR-D85-DLH
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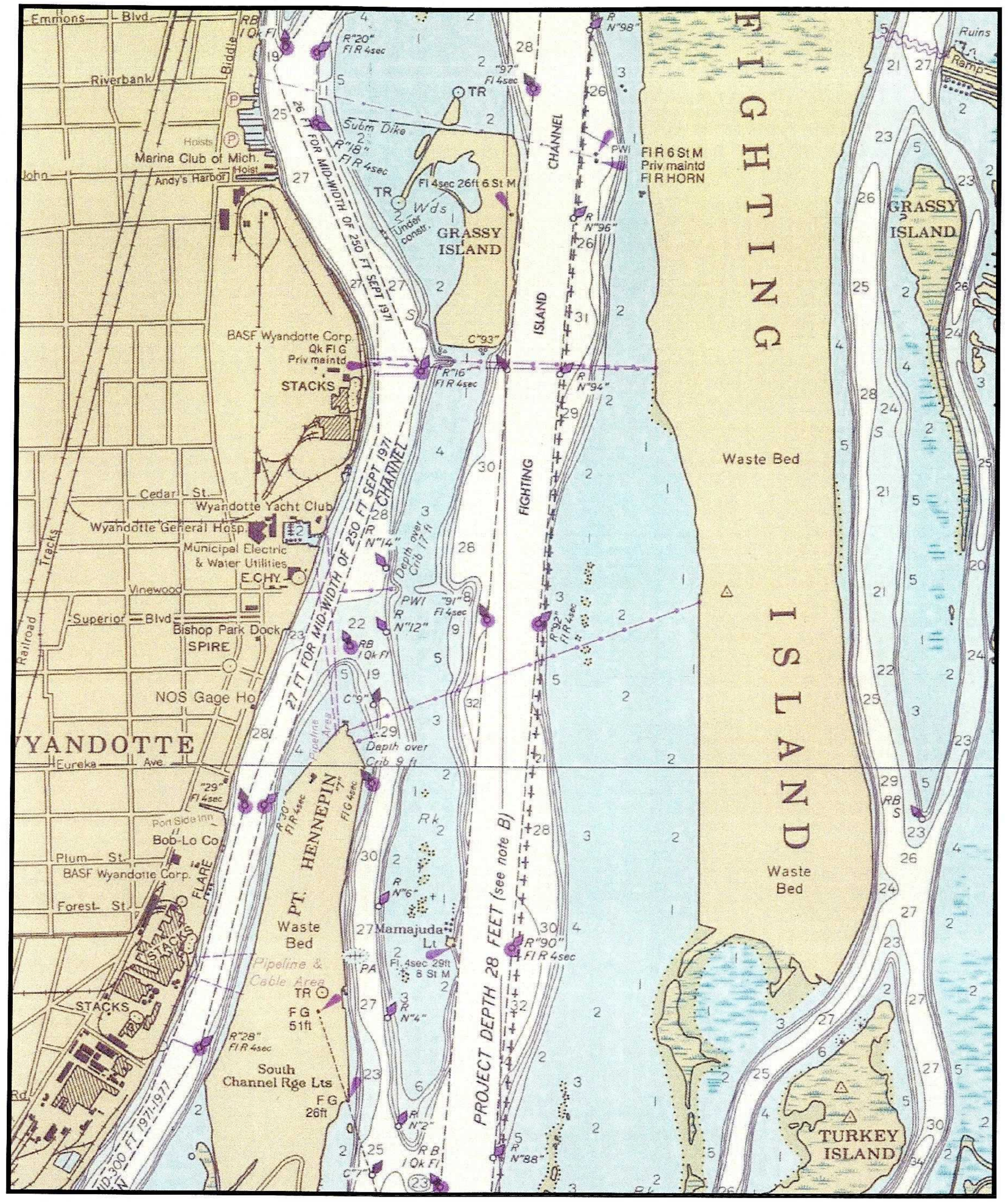

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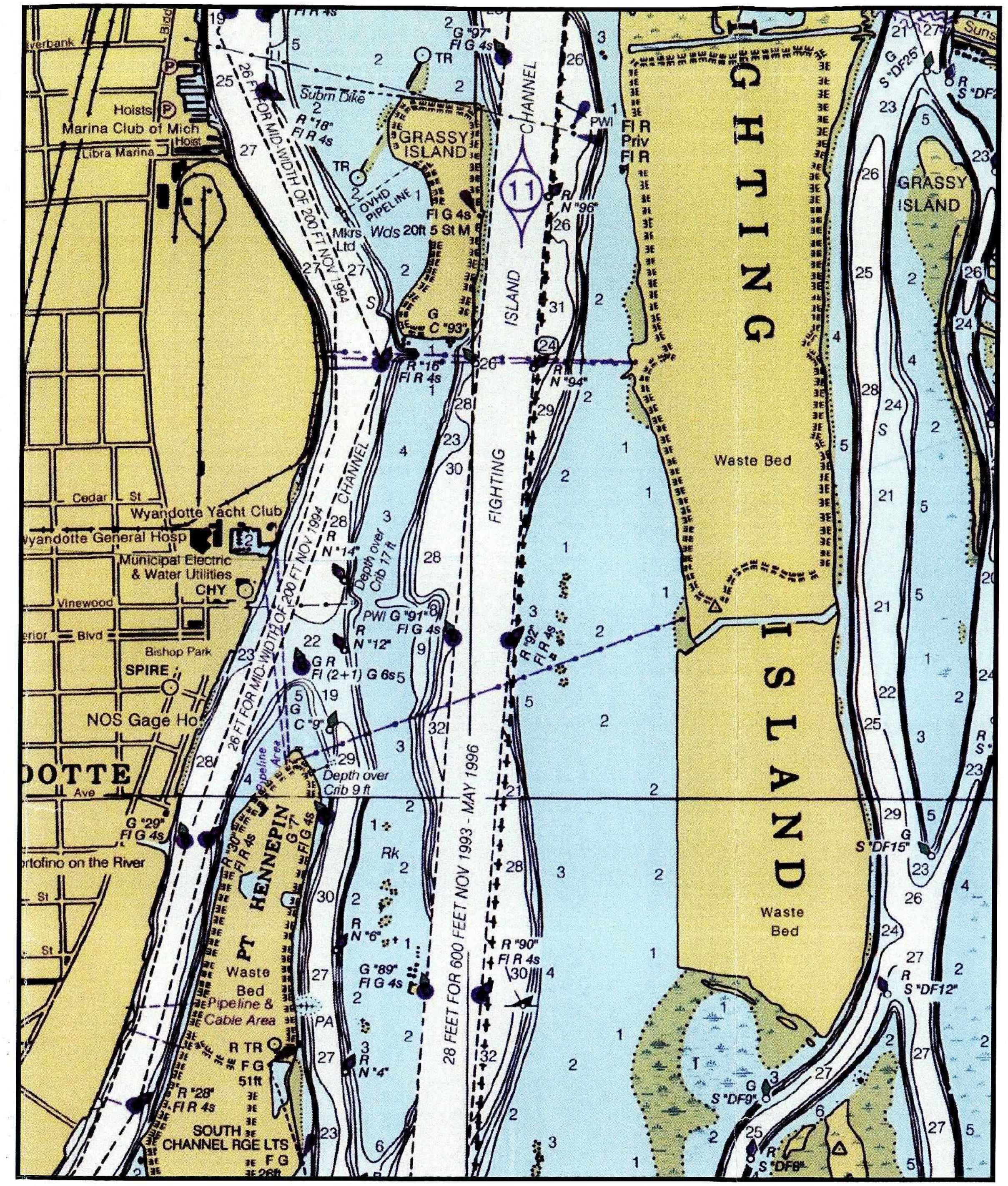

1997

NOTES:

1. HISTORICAL NAVIGATION CHARTS OBTAINED FROM Http://historical.ncd.noaa.gov/historicals/histmap.asp.
2. SOUNDINGS ON NAVIGATION CHARTS REPORTED IN FEET TO THE LOW WATER DATUM.

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

HISTORICAL NAVIGATION CHARTS 1982 - 1997

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FIGURE
3

09/12/06 SYR-D85-DLH
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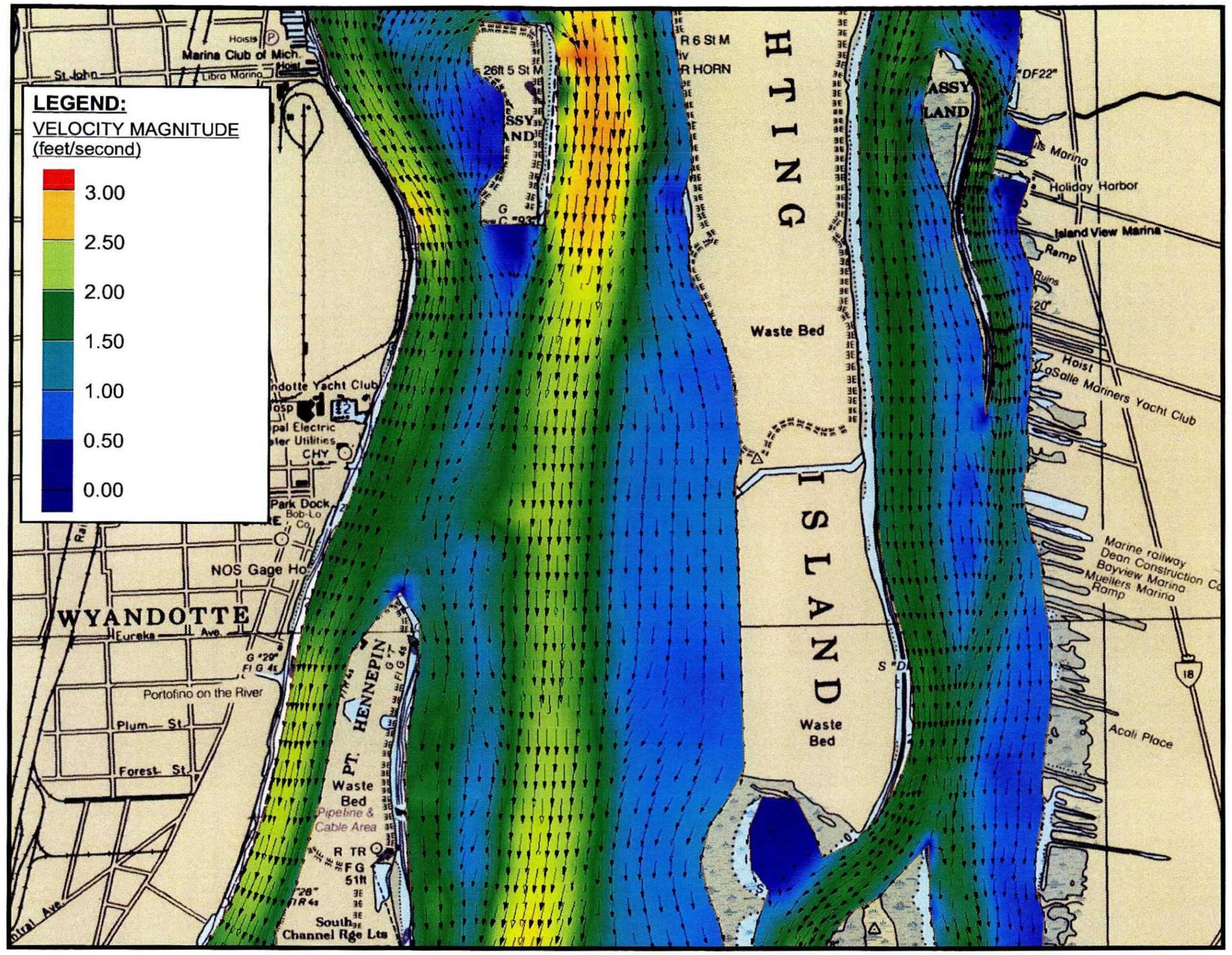

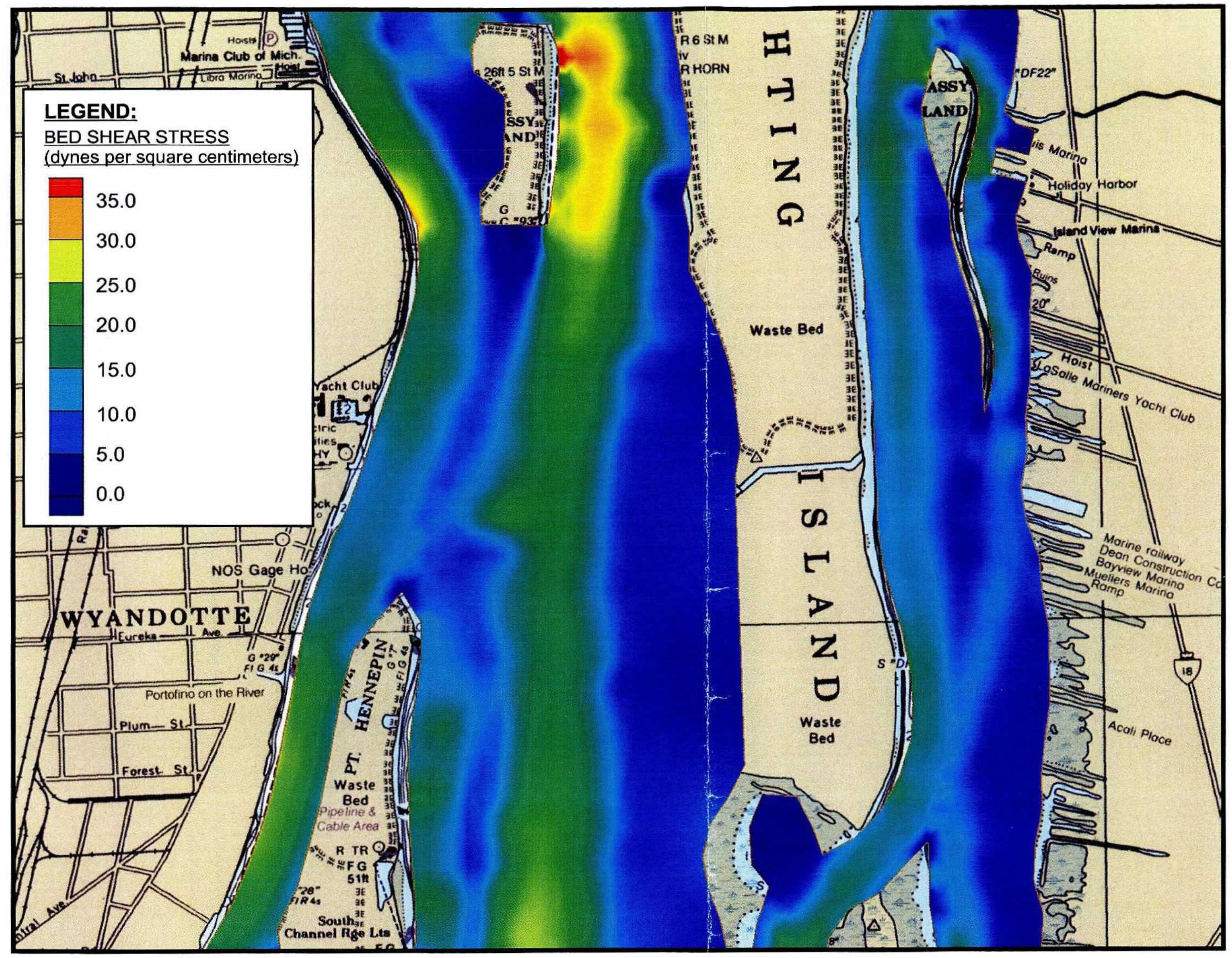

NOTES:

1. ESTIMATED DEPTH-AVERAGED VELOCITY COMPUTED FROM RMA2 HYDRODYNAMIC MODEL.
2. BED SHEAR STRESS COMPUTED USING MANNING'S EQUATION AND A MANNING'S n EQUAL TO 0.033.
3. MANNING'S n FOR THIS REACH OF THE RIVER DETERMINED BY USACE.
4. RMA-2 MODEL OBTAINED FROM HOTLSCLAG, D.J. AND KOSCHIK, J.A. 2002. "A TWO-DIMENSIONAL HYDRODYNAMIC MODEL OF THE ST. CLAIR - DETROIT RIVER WATERWAY IN THE GREAT LAKES BASIN." U.S. DEPARTMENT OF THE INTERIOR AND U.S. GEOLOGICAL SURVEY WATER RESOURCES INVESTIGATIONS REPORT 0-4236. LANSING, MI. AVAILABLE ON LINE AT: HTTP://MI.WATER.USGS.GOV/PUBS/WRIR/WRIR01 4236/DOCS/SCDFLOWMODELINPUT.PHP

2000' 0 2000'

Graphic Scale: 1 = 2000'

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

COMPUTED VELOCITY MAGNITUDES AND BED SHEAR STRESS USING RMA-2 DURING SEICHE EVENT

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FIGURE
4

09/12/06 SYR-D85-DLH-KLS
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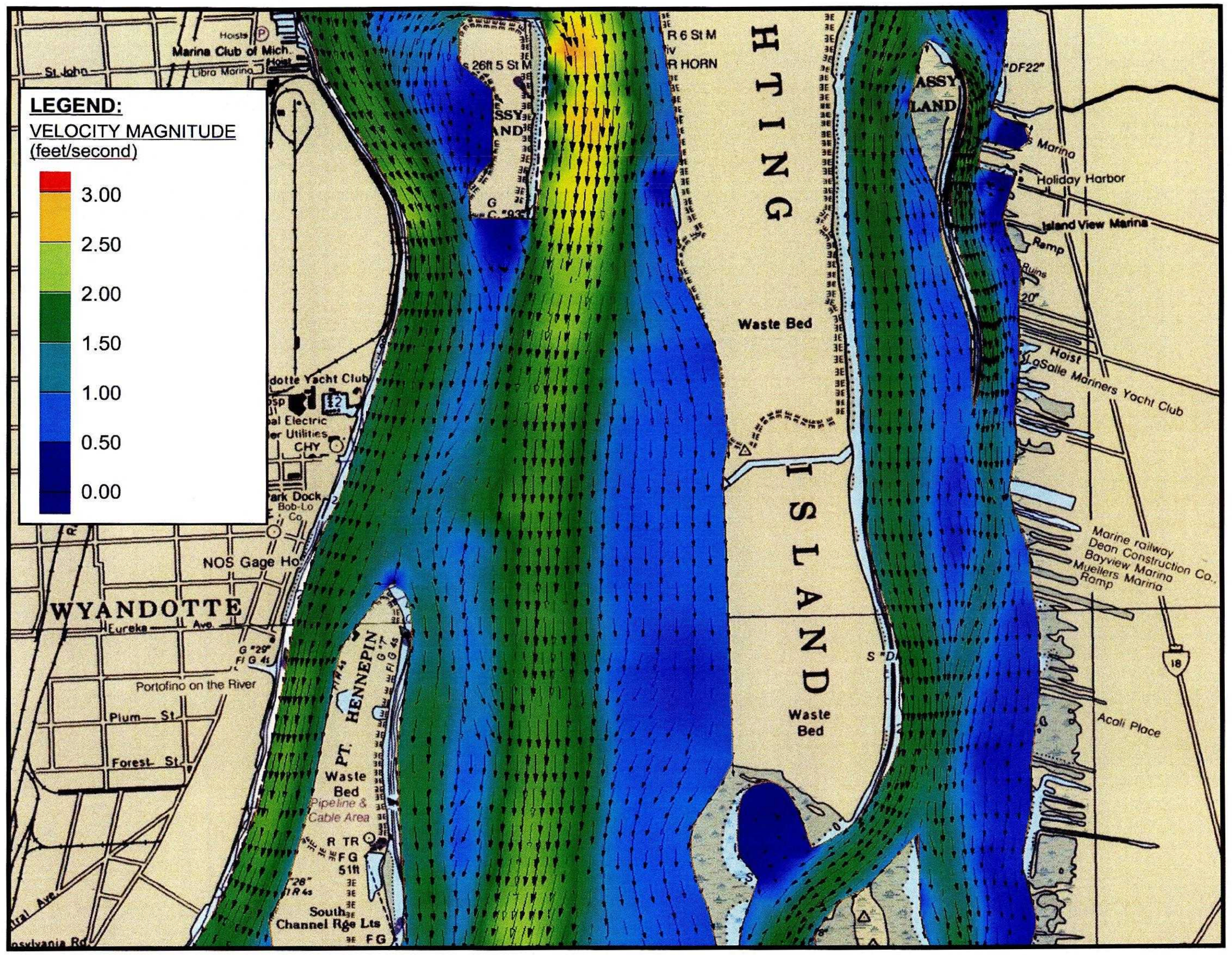

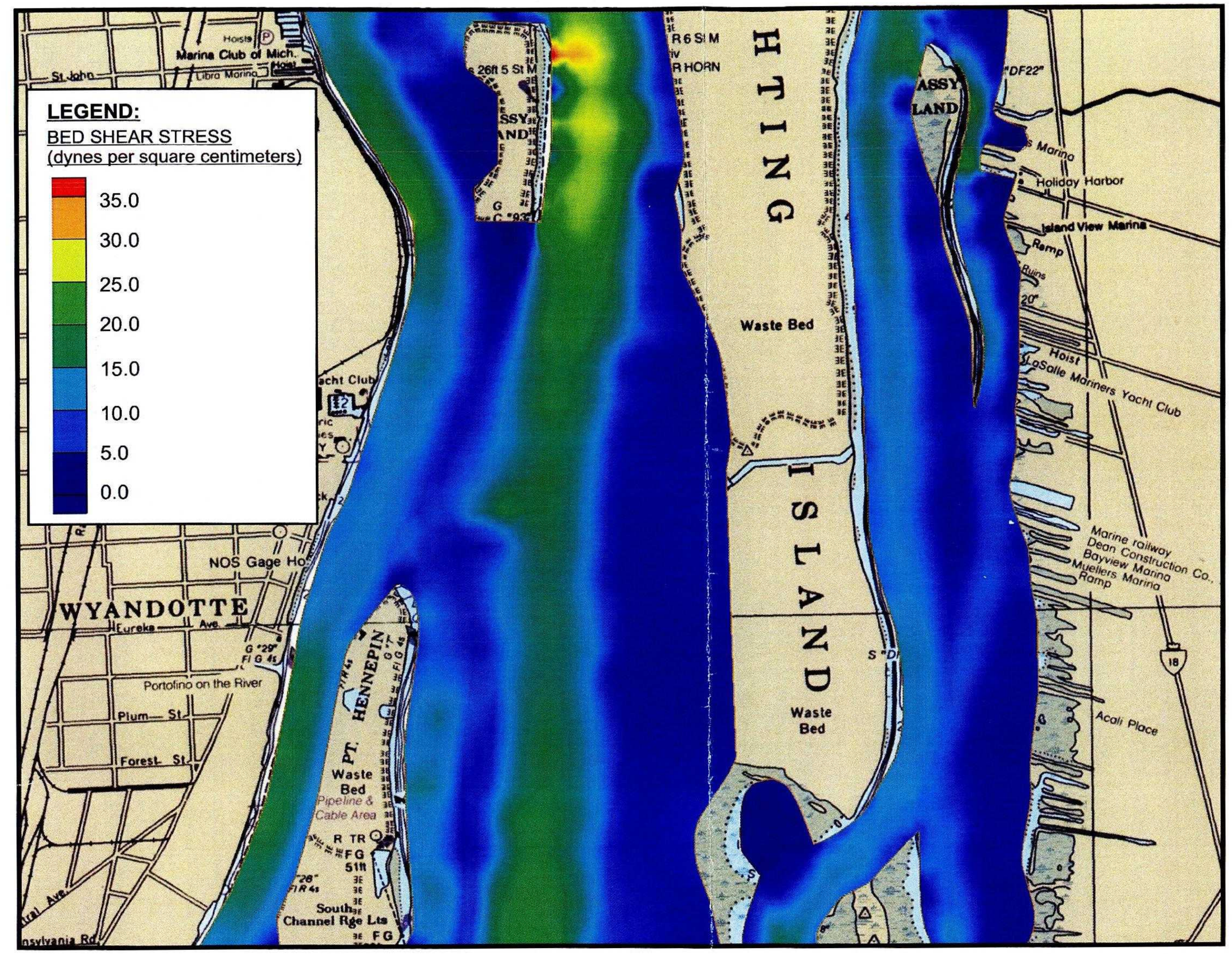

NOTES:

1. ESTIMATED DEPTH-AVERAGED VELOCITY COMPUTED FROM RMA2 HYDRODYNAMIC MODEL.
2. BED SHEAR STRESS COMPUTED USING MANNING'S EQUATION AND A MANNING'S n EQUAL TO 0.033.
3. MANNING'S n FOR THIS REACH OF THE RIVER DETERMINED BY USACE.
4. RMA-2 MODEL OBTAINED FROM HOTLSCLAG, D.J. AND KOSCHIK, J.A. 2002. "A TWO-DIMENSIONAL HYDRODYNAMIC MODEL OF THE ST. CLAIR - DETROIT RIVER WATERWAY IN THE GREAT LAKES BASIN." U.S. DEPARTMENT OF THE INTERIOR AND U.S. GEOLOGICAL SURVEY WATER RESOURCES INVESTIGATIONS REPORT 0-4236. LANSING MI. AVAILABLE ON LINE AT: HTTP://MI.WATER.USGS.GOV/PUBS/WRIR/WRIR01 4236/DOCS/SCDFLOWMODELINPUT.PHP

2000' 0 2000'

Graphic Scale: 1 = 2000'

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

COMPUTED VELOCITY MAGNITUDES AND BED SHEAR STRESS USING RMA-2 DURING LOW FLOW EVENT

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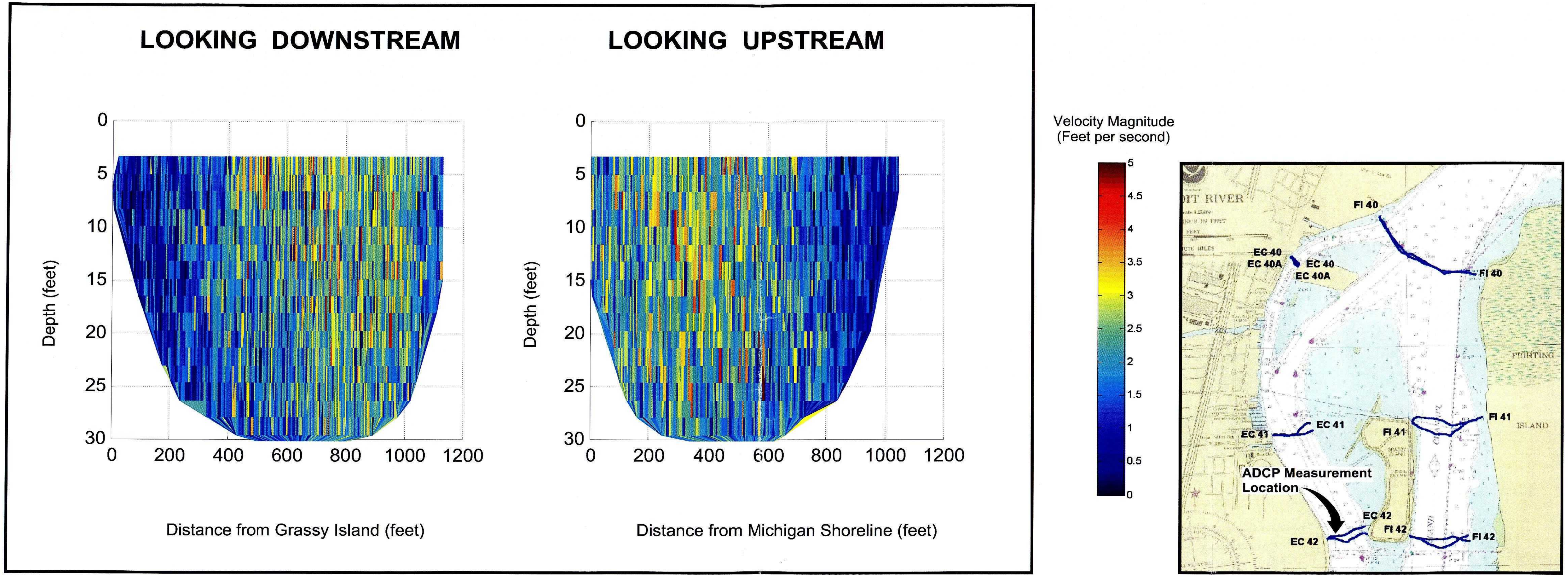
FIGURE
5

09/12/06 SYR-D85-DLH-KLS
42929002/42929g02.cdr



NOTES:

1. ADCP MEASUREMENTS OBTAINED FROM http://mi.water.usgs.gov/pubs/of/OF03-219/images/sheet10.html
2. SOUNDINGS ON NAVIGATION CHARTS REPORTED IN FEET TO THE LOW WATER DATUM.

BASF CORPORATION
WYANDOTTE, MICHIGAN
BASF NORTH WORKS

USGS ADCP MEASUREMENTS IN THE TRENTON CHANNEL

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FIGURE 6

09/22/06 SYR-D85-KLS
42924002/42924G01.CDR

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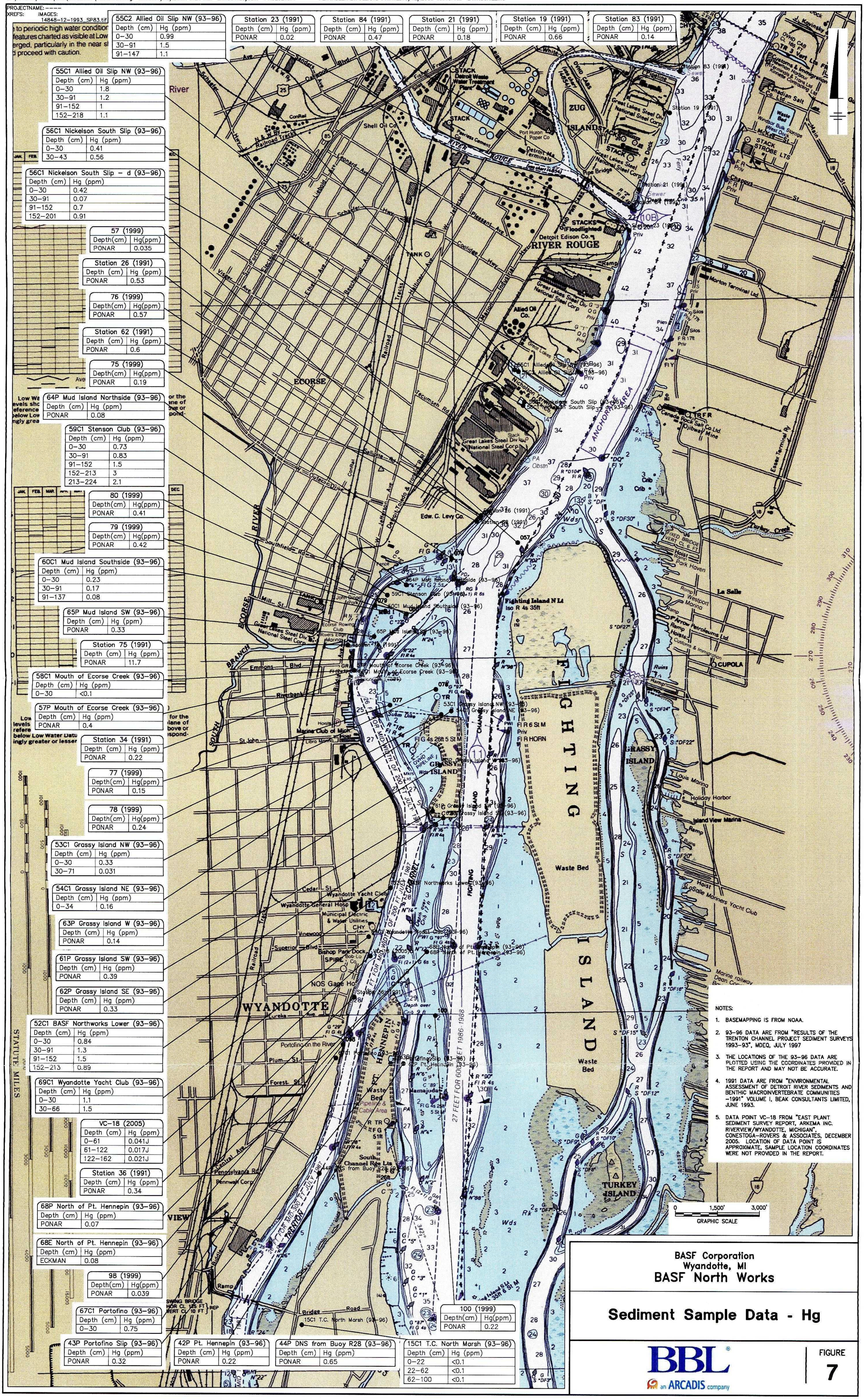


55C2 Allied Oil Slip NW (93-96)

Depth (cm)	Hg (ppm)
0-30	0.99
30-91	1.5
91-147	1.1

Station 23 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.02

Station 84 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.47

Station 21 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.18

Station 19 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.66

Station 83 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.14

55C1 Allied Oil Slip NW (93-96)

Depth (cm)	Hg (ppm)
0-30	1.8
30-91	1.2
91-152	1
152-218	1.1

56C1 Nickelson South Slip (93-96)

Depth (cm)	Hg (ppm)
0-30	0.41
30-43	0.56

56C1 Nickelson South Slip - d (93-96)

Depth (cm)	Hg (ppm)
0-30	0.42
30-91	0.07
91-152	0.7
152-201	0.91

57 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.035

Station 26 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.53

76 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.57

Station 62 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.6

75 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.19

64P Mud Island Northside (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.08

59C1 Stenson Club (93-96)

Depth (cm)	Hg (ppm)
0-30	0.73
30-91	0.83
91-152	1.5
152-213	3
213-224	2.1

80 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.41

79 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.42

60C1 Mud Island Southside (93-96)

Depth (cm)	Hg (ppm)
0-30	0.23
30-91	0.17
91-137	0.08

65P Mud Island SW (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.33

Station 75 (1991)

Depth (cm)	Hg (ppm)
PONAR	11.7

58C1 Mouth of Ecorse Creek (93-96)

Depth (cm)	Hg (ppm)
0-30	<0.1

57P Mouth of Ecorse Creek (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.4

Station 34 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.22

77 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.15

78 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.24

53C1 Grassy Island NW (93-96)

Depth (cm)	Hg (ppm)
0-30	0.33
30-71	0.031

54C1 Grassy Island NE (93-96)

Depth (cm)	Hg (ppm)
0-34	0.16

63P Grassy Island W (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.14

61P Grassy Island SW (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.39

62P Grassy Island SE (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.33

52C1 BASF Northworks Lower (93-96)

Depth (cm)	Hg (ppm)
0-30	0.84
30-91	1.3
91-152	1.5
152-213	0.89

69C1 Wyandotte Yacht Club (93-96)

Depth (cm)	Hg (ppm)
0-30	1.1
30-66	1.5

VC-18 (2005)

Depth (cm)	Hg (ppm)
0-61	0.041J
61-122	0.017J
122-162	0.021J

Station 36 (1991)

Depth (cm)	Hg (ppm)
PONAR	0.34

68P North of Pt. Hennepin (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.07

68E North of Pt. Hennepin (93-96)

Depth (cm)	Hg (ppm)
ECKMAN	0.08

98 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.039

67C1 Portofino (93-96)

Depth (cm)	Hg (ppm)
0-30	0.75

43P Portofino Slip (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.32

42P Pt. Hennepin (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.22

44P DNS from Buoy R28 (93-96)

Depth (cm)	Hg (ppm)
PONAR	0.65

15C1 T.C. North Marsh (93-96)

Depth (cm)	Hg (ppm)
0-22	<0.1
22-62	<0.1
62-100	<0.1

100 (1999)

Depth(cm)	Hg(ppm)
PONAR	0.22

NOTES:

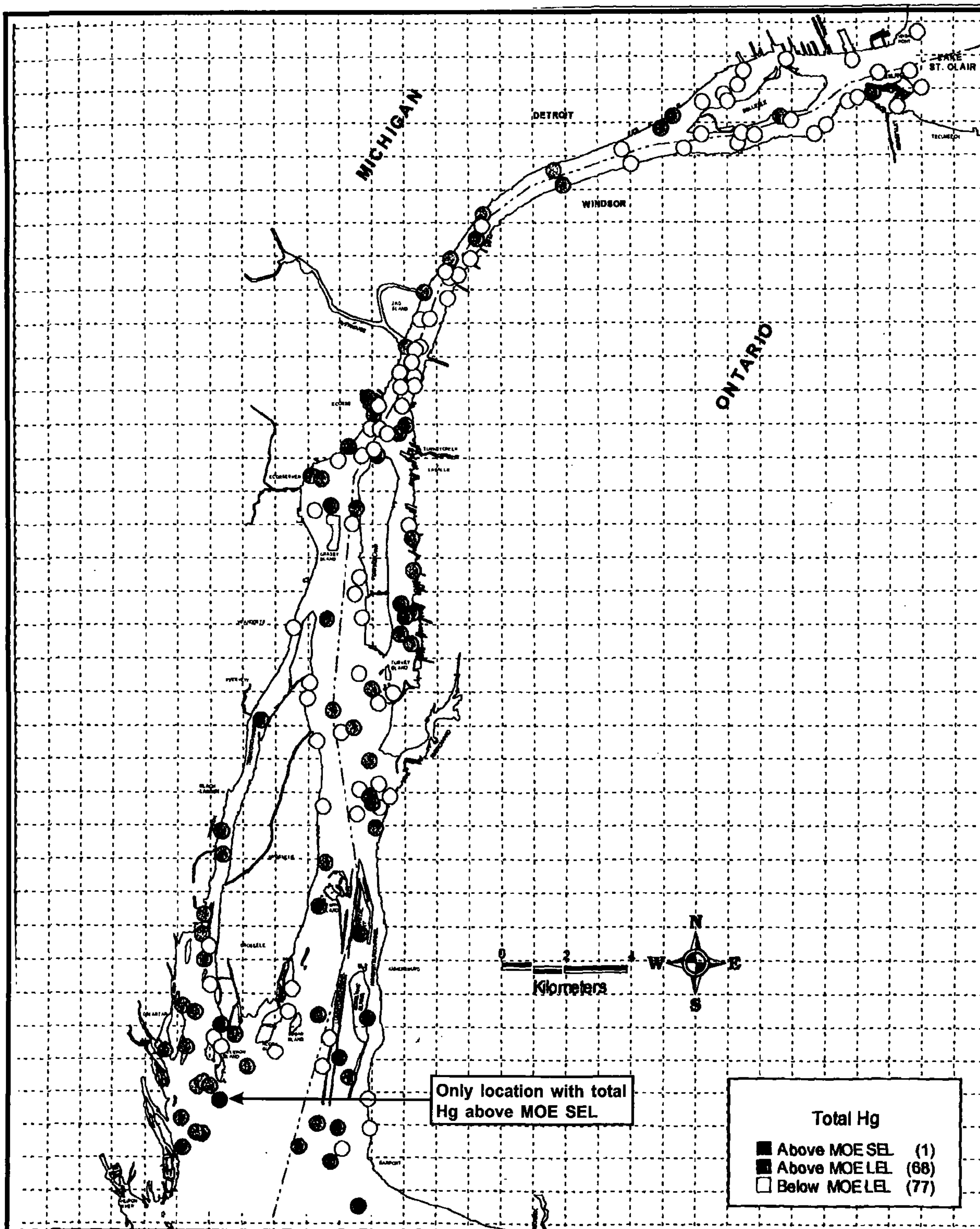
1. BASEMAPPING IS FROM NOAA.
2. 93-96 DATA ARE FROM "RESULTS OF THE TRENTON CHANNEL PROJECT SEDIMENT SURVEYS 1993-93", MDEQ, JULY 1997
3. THE LOCATIONS OF THE 93-96 DATA ARE PLOTTED USING THE COORDINATES PROVIDED IN THE REPORT AND MAY NOT BE ACCURATE.
4. 1991 DATA ARE FROM "ENVIRONMENTAL ASSESSMENT OF DETROIT RIVER SEDIMENTS AND BENTHIC MACROINVERTEBRATE COMMUNITIES -1991" VOLUME I, BEAK CONSULTANTS LIMITED, JUNE 1993.
5. DATA POINT VC-18 FROM "EAST PLANT SEDIMENT SURVEY REPORT, ARKEMA INC. RIVERVIEW/WYANDOTTE, MICHIGAN", CONESTOGA-ROVERS & ASSOCIATES, DECEMBER 2005. LOCATION OF DATA POINT IS APPROXIMATE, SAMPLE LOCATION COORDINATES WERE NOT PROVIDED IN THE REPORT.

BASF Corporation
Wyandotte, MI
BASF North Works

Sediment Sample Data - Hg

BBL an ARCADIS company

FIGURE
7



REFERENCE:
GREAT LAKES INSTITUTE FOR ENVIRONMENTAL RESEARCH (GLIER), UNIVERSITY OF WINDSOR. 2002. DETROIT RIVER MODELLING AND MANAGEMENT FRAMEWORK, INTERPRETIVE REPORT (DRAFT). PREPARED FOR DETROIT RIVER CANADIAN CLEANUP COMMITTEE (APRIL 2002).

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MERCURY CONCENTRATIONS ABOVE MOE SEDIMENT QUALITY GUIDELINES IN THE DETROIT RIVER SURFICIAL SEDIMENT DEPOSITS 1999

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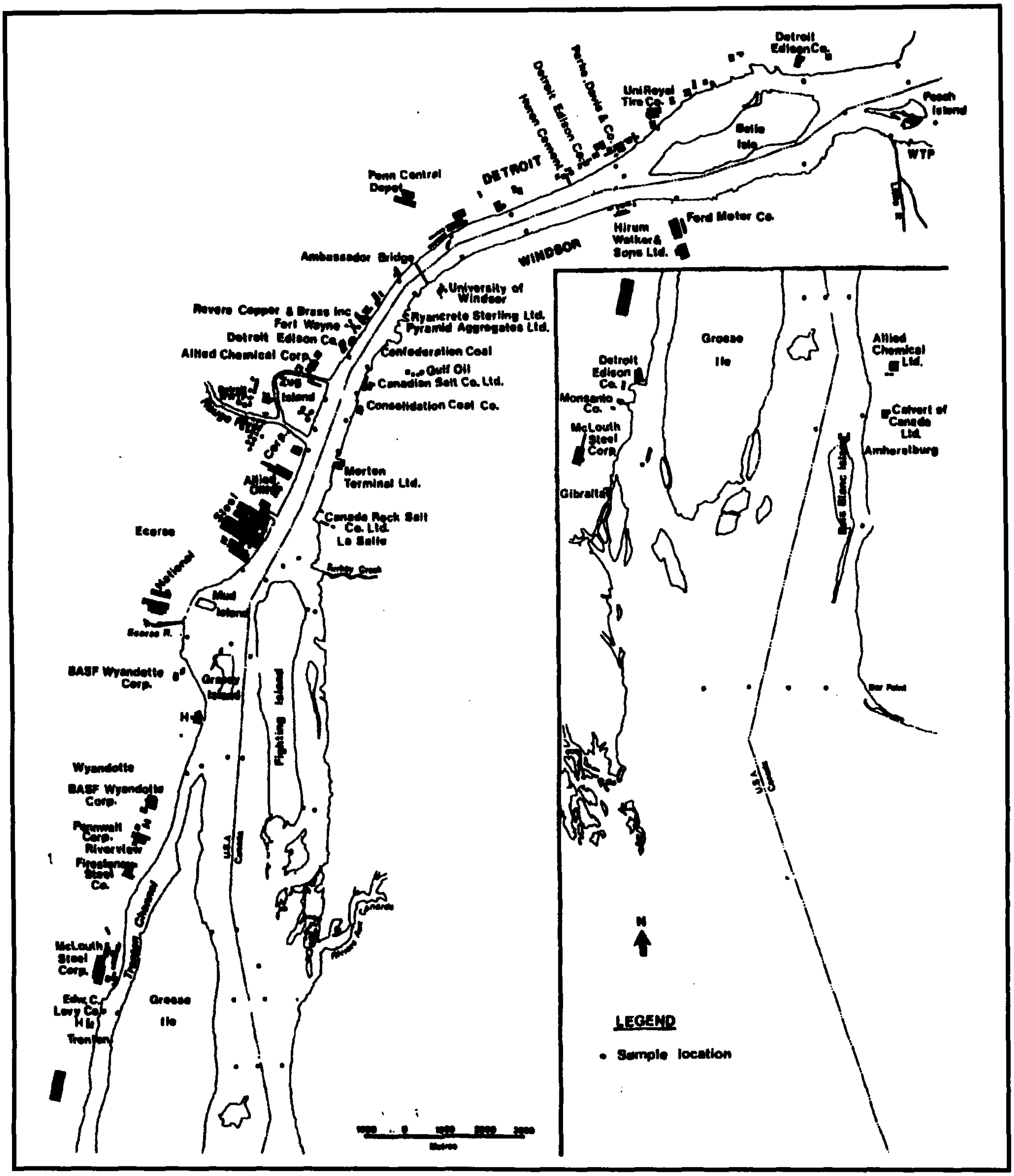
FIGURE
8

09/22/06 SYR-D85-DLH-KLS
42929002/42929g05.cdr



REFERENCE:
FIGURE 1(b) - FROM HAMDY, Y. AND L. POST. 1985. DISTRIBUTION OF MERCURY, TRACE ORGANICS, AND OTHER HEAVY METALS IN DETROIT RIVER SEDIMENTS. J. GREAT LAKES . RES. 11(3): 353-365

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INDUSTRIAL DEVELOPMENT ALONG THE DETROIT RIVER AND 1980 SEDIMENT SAMPLING LOCATIONS

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FIGURE
9

09/12/06 SYR-D85-DLH-KLS
42929002/42929g04.cdr

Attachment 1

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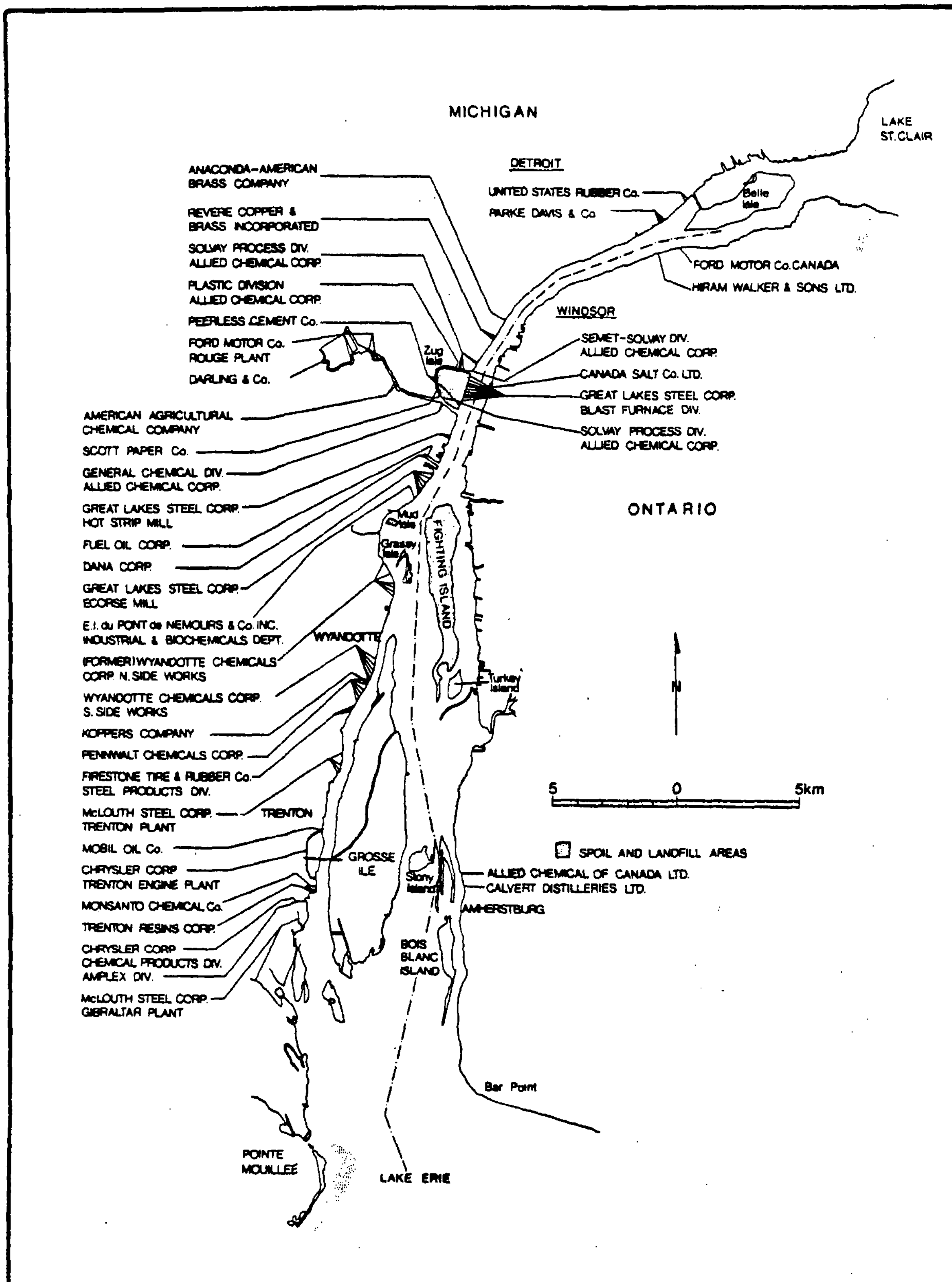

FIGURE IX-15. Industrial dischargers to the Detroit River.

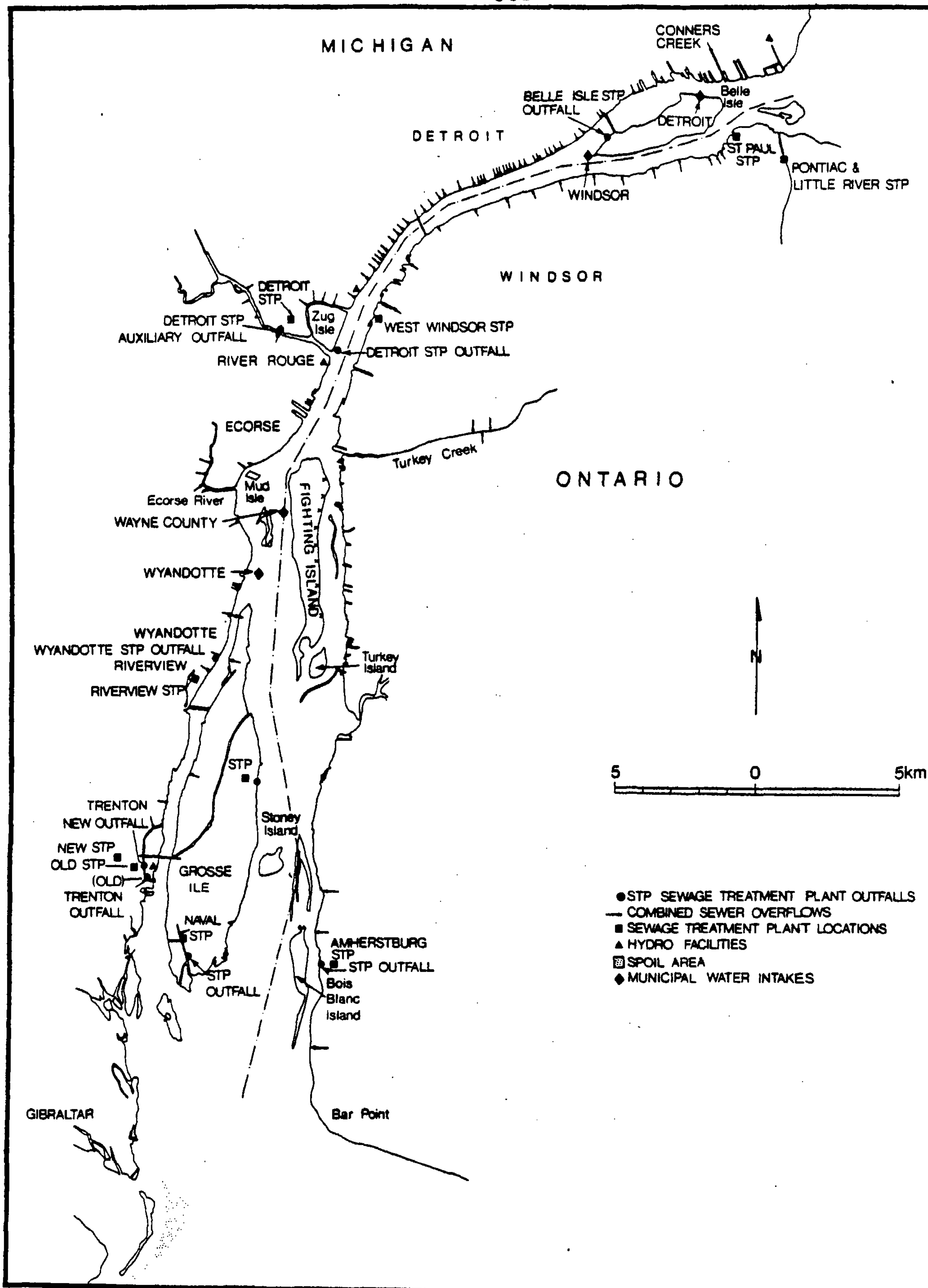

FIGURE IX-16. Municipal dischargers to the Detroit River.

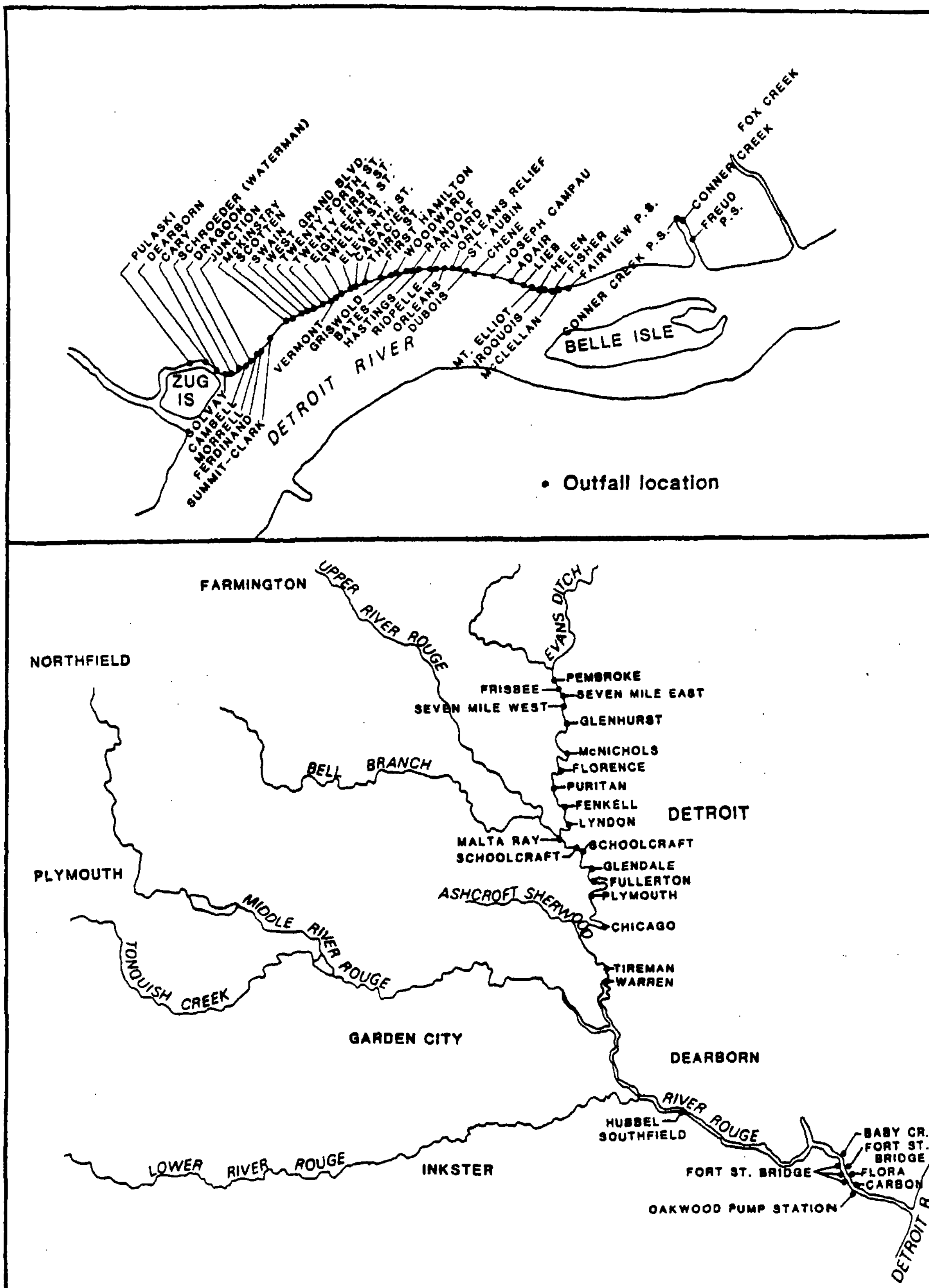

FIGURE IX-17. U.S. Combined sewer overflows discharging to the Detroit and Rouge Rivers.

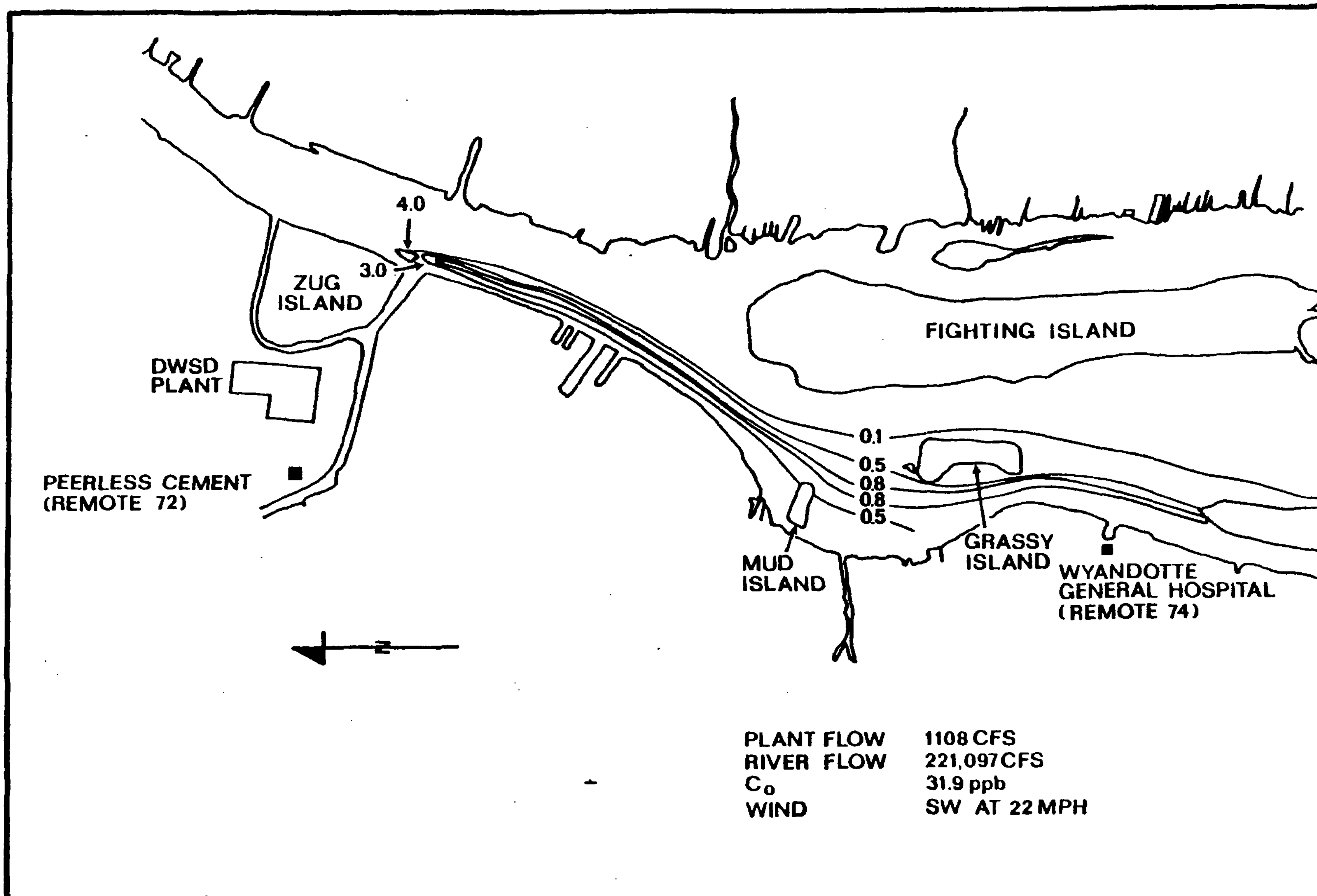

FIGURE IX-5. Plume from the City of Detroit WWTP, March 1985 (28).

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November 14, 2006

Mr. Juan Thomas
Project Manager, RCRA Corrective Action Section
U.S. Environmental Protection Agency, Region V
77 West Jackson Boulevard (DE-9J)
Chicago, Illinois 60604

Subject: Sedimentation Conditions in the Trenton Channel
BASF Corporation, North Works Property
Wyandotte, Michigan (Docket #: V-W-011-94)

Dear Mr. Thomas:

In a letter to BASF dated June 15, 2006, the United States Environmental Protection Agency (EPA) communicated the following expectations to BASF in regards to the Corrective Measures Study (CMS) in progress for BASF's North Works Site in Wyandotte, Michigan:

- A "map of navigational channel that may establish whether the area adjacent to the river is a depositional area"; and
- "An evaluation of sediments that first verifies the presence/absence of sediment and if present, collect samples adjacent to the site as well as upstream and downstream to characterize sediment quality relative to background. Sediments would be analyzed for constituents including mercury."

These expectations go beyond action items discussed previously for completion of the CMS. Moreover, they are well outside the scope of what was approved by EPA much earlier in March 1999 following its review of BASF's *Final BASF Phase I RFI Report* (QST, 1999). The information presented in the enclosed report is consistent with this document. The RFI Report concluded:

- "Acquiring additional sediment sample data in the vicinity of the Facility would be an impractical/ineffectual process of limited utility."

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- "In addition to the flow dynamics and sediment deposition characteristics adjacent to the Facility, uncertainty associated with identifying the specific origins of historic pollutants in a heavily industrialized area such as that upstream of BASF also presents a significant deterrent at attempts of accurate, meaningful sediment characterization."

This letter summarizes BASF's current knowledge concerning the hydraulics within the Trenton Channel, the non-depositional nature of the Trenton Channel adjacent to the North Works, and the sediment quality in near-by downstream and upstream areas. BASF requested Blasland, Bouck & Lee to assemble available data and present their findings in a report, a copy of which is enclosed. From that report, BASF concludes there is no advantage to including an evaluation of sediments in the CMS. In summary, available data show:

- Historical navigational charts show unchanging channel depths, including areas outside of the dredged channel boundaries for the past 100+ years. This finding demonstrates a lack of sediment accumulation.
- The Trenton Channel adjacent to the North Works is a swift flowing stream. Flow velocities and resultant shear stresses do not permit deposition of fine-grained sediments.
- All previous sediment-sampling programs ignored areas adjacent to North Works most likely due to the swift flow velocities and lack of sediment accumulation.
- Upstream contaminant sources are well documented, and have contributed to sediment quality impairment throughout the Trenton Channel. Available sediment quality data show similar concentrations of metals (including mercury) upstream and downstream of the North Works. In fact, nearby upstream samples have higher maximum mercury concentrations than in the nearest downstream sediment samples.
- A comparison of the concentrations of metals in upstream sediment samples versus downstream sediment samples shows no statistically significant trend.
- A sediment core from the closest downstream depositional area, the Wyandotte Yacht Club harbor, showed mercury levels that although relatively low, are also in the range of typical values observed in sediments upstream of the Site.
- There are no known past or present manufacturing processes conducted at the site that would contribute to mercury impacts in the Trenton channel.

For these reasons, BASF respectfully declines to conduct sediment sampling in the Detroit River adjacent to its North Works property as part of the CMS. Existing data demonstrates that there is no need for such additional sampling. Not only is there an indication of an absence of sediments off shore of the North Works, but also evidence of widespread sediment impairment from the many industrial and municipal sources upstream.

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To assist you and your team in understanding the scenario summarized in this letter and more fully described in the accompanying report, BASF's offer to tour the river by boat is still available. BASF believes that this type of inspection is essential in giving EPA the proper perspective regarding the sediment issues.

Please contact me at (215) 672-4119, or the new BASF manager for this project Michael Gerdenich (734) 324-6298, if you have any comments on the report or would like to discuss.

Sincerely,

Brian Diepeveen MKD

Brian Diepeveen
Remediation Manager

Enclosure

cc: Michael Gerdenich, BASF
Michael Erickson, BBL
Randy Ellis, ENSR
Beth Vens, DEQ
Dave Slayton, DEQ
Jack Lanigan, Jack Lanigan Corporation

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